Province of British Columbia
Ministry of Environment

VEGETATION RESOURCES OF THE JARVIS CREEK-MORKILL RIVER AREA

Prepared by

COMEAU ECOLOGICAL CONSULTANTS LTD.
SURREY, BRITISH COLUMBIA

and

Waste Management Branch
MINISTRY OF ENVIRONMENT
PROVINCE OF BRITISH COLUMBIA

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ABSTRACT

This report is concerned with the vegetation resources of the Jarvis Creek-Morkill River Area.

The vegetation of the Study Area is characterized by three forest regions: the Boreal Region, the Subboreal Region and the Interior Wet Belt Region. Within each of these regions, several zones and subzones are recognized.

A standard reconnaissance survey was carried out and 256 vegetation plots were sampled during the summer of 1977. Computer analysis by means of the vegetation classification package called COENOS 1 resulted in the delineation of twenty-eight vegetation types.

The relationship between the vegetation types and environmental factors is examined as are the successional trends of the vegetation of the Study Area.

Several interpretations are presented for each vegetation type including interpretations for agriculture, conservation, forestry, mine reclamation, recreation and wildlife. These general interpretations serve to aid the resource manager in making land management decisions.

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PREFACE

Vegetation Resources of the Jarvis Creek-Morkill River area is one of a series of reports undertaken by the Resource Analysis Branch (now Surveys and Resource Mapping Branch) of the British Columbia Ministry of Environment on the biophysical resources of the Northeast Coal Study Area (See Appendix D). It contains detailed information on the vegetation resources of the Jarvis Creek-Morkill River area and provides a number of interpretations for resource management of this area.

The field data on which this report is based were collected during the summer of 1977 by Adolf Ceska along with personnel of the Resource Analysis Branch of the British Columbia Ministry of Environment.

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CHAPTER ONE
INTRODUCTION

1.1 OBJECTIVES OF THE STUDY

This report on the vegetation resources of the Jarvis Creek-Morkill River a continuation of the earlier report on the vegetation resources of the 1976-1977 Study Area (the Core Area of the Northeast Coal Block) entitled Vegetation Resources of the Northeast Coal Study Area, 1976-1977 (Harcombe, 1978). The areas which have been studied during the 1976-1977 and 1977-1978 field seasons are indicated in Figures 1.1 and 1.2.

The specific objectives of the vegetation study of this area were:

a. to describe and classify the vegetation to detailed vegetation types;
b. to determine the relationship of vegetation to climate, terrain, soils, topography, nutrient cycling and moisture availability;
c. to determine successional trends in the vegetation in the Study Area and to determine their relationship to environmental factors; and,
d. to use the information gained to develop interpretations for resource management.

1.2 LOCATION AND SETTING OF THE STUDY AREA

The Study Area is located between 53°30' and 54°30' north latitude and 120° and 121° west longitude and may be located on NTS map sheets 93H/9, 10, 15 and 16 and 93I/1, 2, 7 and 8. Additional samples were taken in the vicinity of McBride (Fraser River Valley, Mount Teare, and Bell Mountain), and along the West Torpy River to the northeast of McGregor (Ceska, 1979).

The location of the Study Area is shown in Figures 1.1 and 1.2.

1.2.1 GEOGRAPHY

The Study Area is bounded in the east by the British Columbia - Alberta border, in the south by the Fraser River, in the west by 121° west longitude and by the border with the 1976-1977 Study Area, and in the north by the 1976-1977 Study Area.

The elevational range of the Southeast Extension Study Area is from approximately 680 metres to 3200 metres (2200 to 10,500 ft) above sea level (Ceska, 1979).

1.2.2 PHYSIOGRAPHY

Five major physiographic regions (Holland, 1964) occur within the Study Area and are shown in Figure 1.3. These include:

A. The Rocky Mountain Foothills

This region, which ranges in elevation from 1200 metres to 1800 metres (3900 to 5900 ft) above sea level, parallels the eastern margin of the Rocky Mountains and occurs in the north-

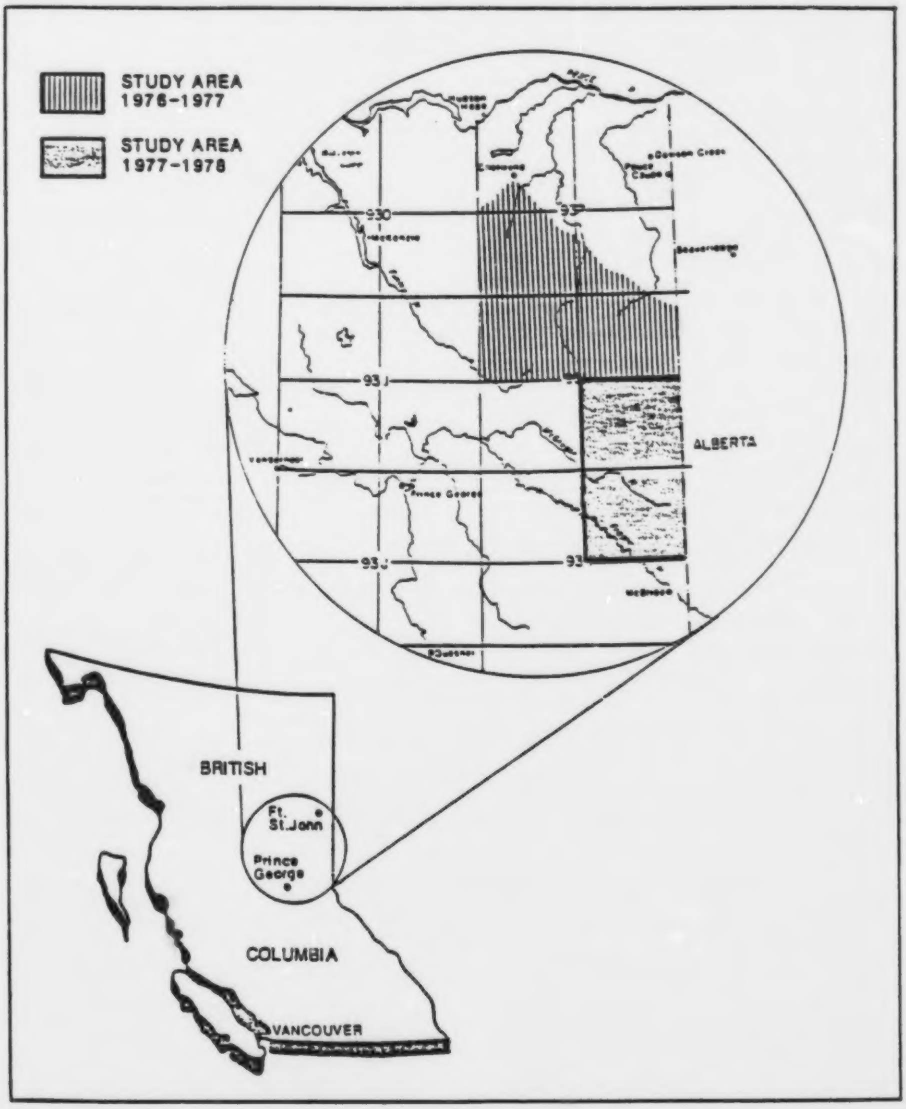
STUDY AREA
1976-1977
STUDY AREA
1977-1978
93O
93P
93J
Dawson Creek
Prince George
ALBERTA
BRITISH
COLUMBIA
Ft. St.John
Prince George
VANCOUVER

Figure 1.1 Location of Study Area.

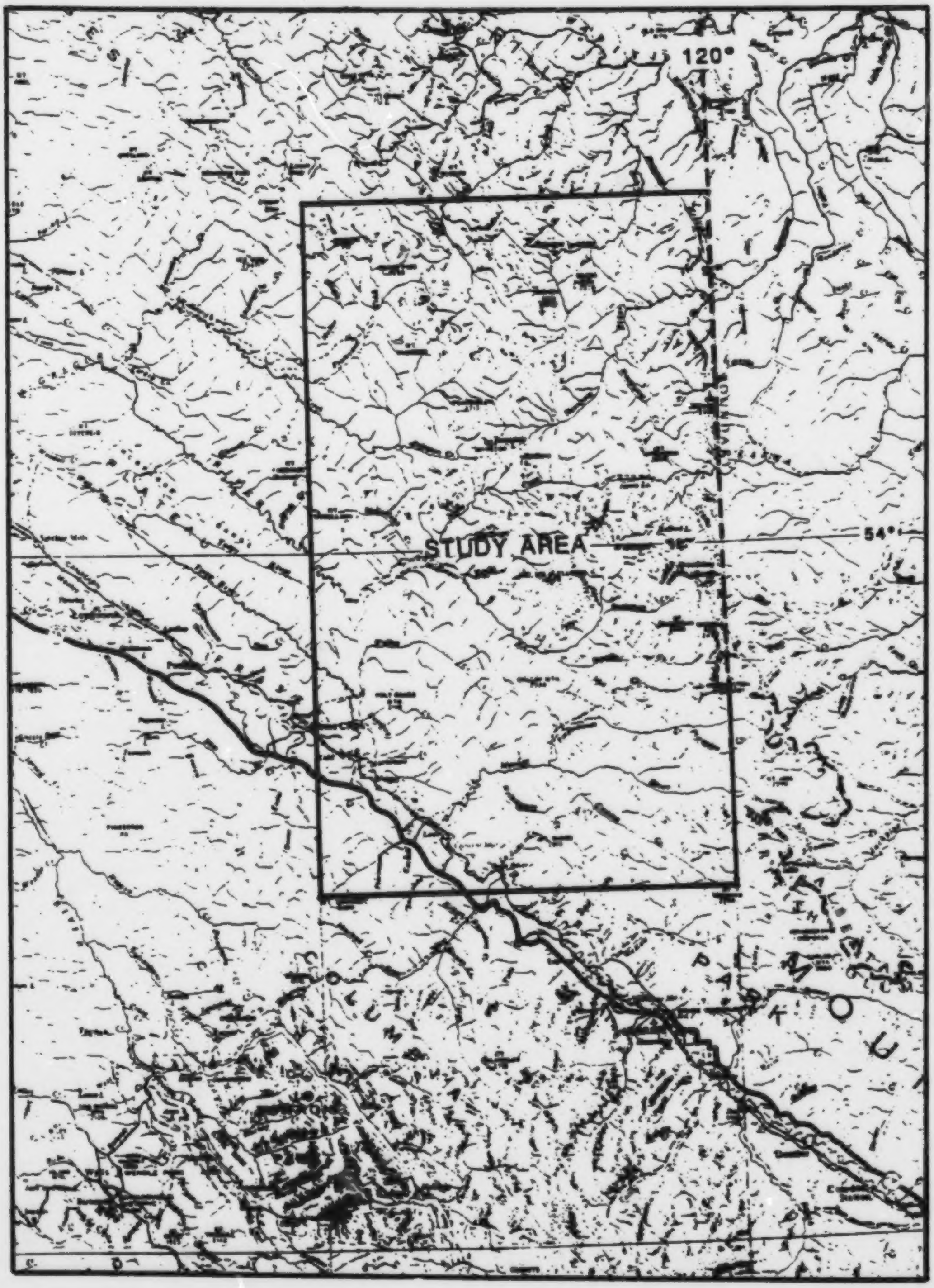
120°
STUDY AREA
54°

Figure 1.2 Study area boundaries.

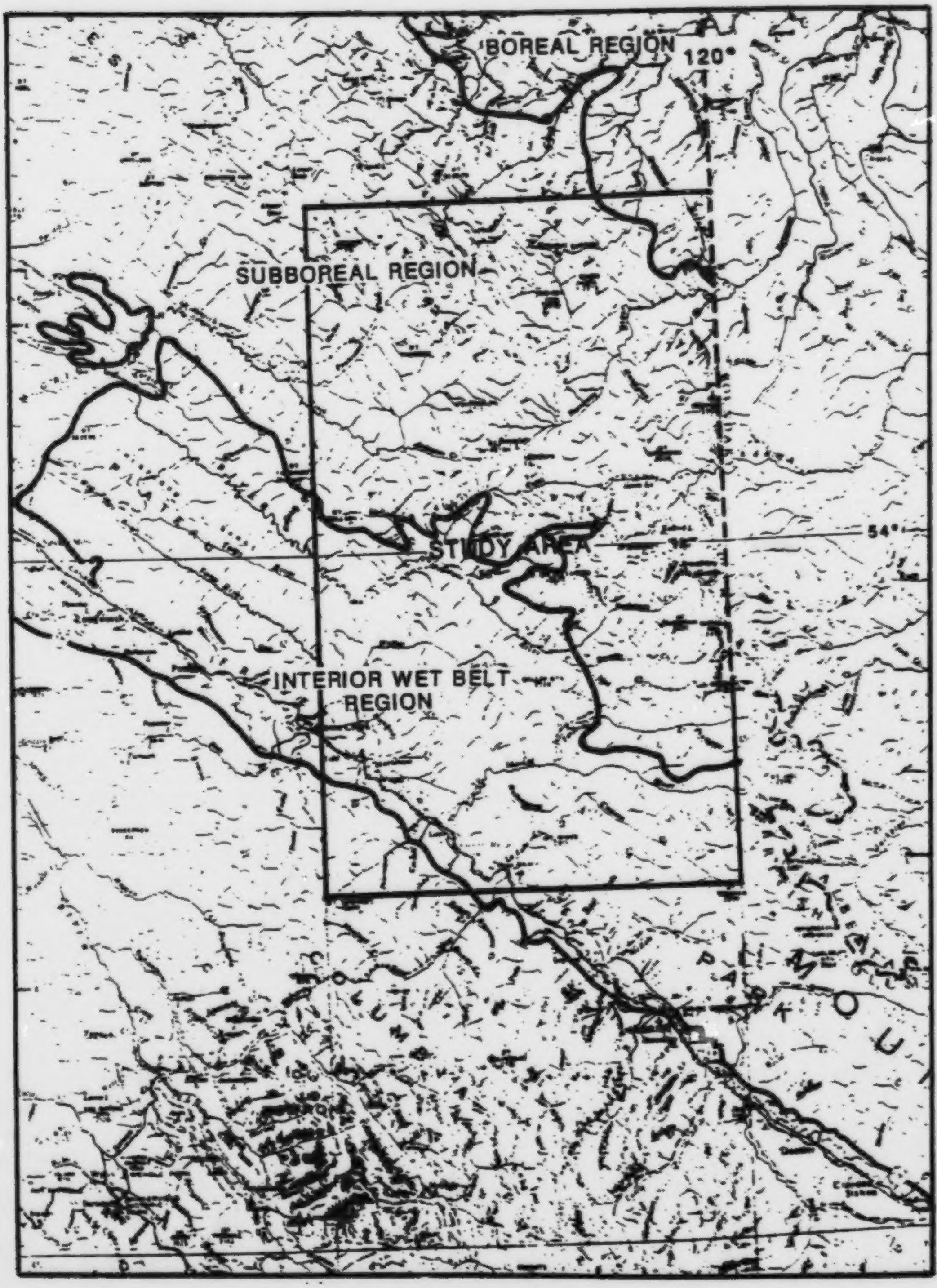
BOREAL REGION
120°
SUBBOREAL REGION
STUDY AREA
54°
INTERIOR WET BELT REGION

Figure 1.3 Forest regions of the study area.

eastern corner of the Study Area. It is dissected by major northeasterly flowing rivers which are entrenched in deep canyons (ELUSC, 1978). In addition, the Rocky Mountain Foothills region lies within the rainshadow of the Rocky Mountains, and, therefore, receives substantially less snowfall than areas to the west of the Rockies. What snow does occur in this region is eliminated by periodic chinook winds.

B. The Rocky Mountains

The Rocky Mountains Region ranges in elevation from 920 metres to more than 3000 metres (3000 to 9800 ft) above sea level and consists of a series of parallel ridges and valleys which extend in a roughly northwesterly direction through the centre of the study area. It is comprised of the Dezaiko Range, the Park Ranges and the Hart Ranges and has as its western boundary the Rocky Mountain Trench and as its eastern boundary, the Rocky Mountain Foothills.

C. The Rocky Mountain Trench

This region occurs in a relatively small area of the southwestern portion of the Study Area along the Fraser River. Elevation of this region is approximately 760 metres (2500 ft) above sea level.

D. The McGregor Plateau

The McGregor Plateau region is present in a small area along the western boundary of the Study Area and consists of a series of parallel ridges which are aligned in a northwest to southeast direction along the western side of the Trench. The elevational range of this region is from 760 metres to more than 1900 metres above sea level.

Because of its relatively high elevation and its location on the windward side of the Rocky Mountains, the McGregor Plateau is subjected to heavy winter snows and supports dense coniferous forests (ELUSC, 1979).

E. The Cariboo Mountains

This region is present in the extreme southwestern corner of the Study Area and lies east of the Quesnel Highland and west of the Rocky Mountain Trench.

1.2.3 GEOLOGY

A. The Rocky Mountain Foothills

The Rocky Mountaion Foothills region includes the coal-bearing areas and is entirely underlain by sedimentary rocks, notably shales and sandstones. Where resistant quartzite or silty limestones occur so do the highest peaks and longitudinal ridges of the area. The lower peaks and valleys occur where the easily eroded, softer interbedded shales are present (Holland, 1964).

The foothills, which were occupied by continental ice during the Pleistocene Epoch have only been slightly modified by glaciation. Generally speaking, the easterly aligned valleys were glaciated by ice moving outward from the mountains whereas the northwesterly aligned valleys were usually not eroded but received a mantle of drift when the ice receded.

B. The Rocky Mountains

This region is largely underlain by sedimentary and metamorphic rocks which are predominantly limestones, dolomites, quartzites, schists and slates. The predominant rocks underlying the major valleys are shales and sandstones. In the Southeast Extension Study Area, the southeastern part of the Rocky Mountains is composed of lime stones and dolomites, with quartzite occurring along the Continental Divide whereas the northwestern part of the Rocky Mountains is composed of conglomerates, phyllites, and shales, with inclusions of quartzites (Ceska, 1979).

During the Pleistocene Epoch, the Rocky Mountains were covered by continental ice to heights of 2100 metres to 2400 metres (7000 to 8000 ft above sea level (Holland, 1964). However, the erosional effects of this glaciation were slight when compared to the erosional effects of alpine and valley glaciers.

C. The Rocky Mountain Trench

Holland (1964) states that the structure of the Trench is largely unknown but it is complex and differs from one place to another. The surficial geology of the Trench results from both glacial and post-glacial events (Ceska, 1979). Although glaciation modified the form of the Trench, the main effect was the derangement of previously established drainage systems (Holland, 1964).

D. The McGregor Plateau

This region, is largely covered by tertiary lava flows. In addition, glacial drift is wide spread and most of the bedrock is obscured.

The McGregor Plateau was occupied by glacial ice and is marked by numerous grooves and drumlin-like ridges which parallel the direction of the ice flow. Other noticeable features of the plateau surface are eskers and meltwater channels.

E. The Cariboo Mountains

The Cariboo Mountains region is composed of sedimentary rocks and metamorphosed sedimentary rocks. Alghough some limestone is present, the predominant rock type is quartzite. This mosaic of rock materials may explain the higher floristic diversity of the Cariboo Mountains Region (Ceska, 1979).

The Cariboo Mountains were heavily glaciated. Peaks which were higher than 2400 metres (8000 ft) and which projected through the ice were subjected to intense frost action and cirque attack (Holland, 1964). The trunk valleys, which were intensely glaciated, exhibit U-shaped profiles.

The majority of the Study Area is covered by glacial tills and extensive lacustrine and fluvial deposits. The glacial materials which are present over most of the Study Area were deposited by the Fraser or late Wisconsin Glaciation. This ice-sheet deposited morainal materials along the sides and bottoms of numerous valleys. A few small, ice-dammed lakes were formed in the Study Area and, as a result of the sedimentation in these lakes, great thicknesses of lacustrine clays, silts, sands, and lesser amounts of lacustrine gravels were deposited (ELUSC, 1978). Only a few ice-dammed lakes were formed east of the Continental Divide. Ice-contact and glacial outwash deposits are also present in the Study Area with outwash deposits frequently occurring as river terraces.

1.2.4 CLIMATE

Short, cool summers, cold winters and light to moderate precipitation characterize the regional climate of the Study Area (Sky, 1979). This climate is strongly influenced by the presence of the Rocky Mountains. Rain and cloudiness are more common in the western mountain ranges and tend to increase with elevation and proximity to the Continental Divide (Sky, 1979). This is due to the fact that the humid, coastal air masses travelling from the west are forced to rise as they reach the mountains resulting in a release of considerable amounts of precipitation, in the form of rain and snow, on the western or windward side of the mountains. The air mass is then considerably drier, and sometimes warmer, when it reaches the leeward or eastern side of the mountains.

The study area is frequently subjected to Arctic air from the northeast during the winter months. The mountains act as a barrier to the westward flow of this cold stable air with the result that the winter temperatures along the eastern slopes of the Rocky Mountains are much lower than those along the western slopes.

When these two climatic effects are combined, the result is that the eastern side of the Continental Divide tends to have lower annual precipitation and lower mean annual temperatures.

Individual climatic parameters for the Study Area are discussed in depth in the following technical reports. All reports are listed in Appendix D.

ELUSC. 1978. Northeast Coal Study Preliminary Environmental Report, 1977-1978.

Sky, K. 1982. Outdoor Recreation Resources of the Northeast Coal Study Area, 1977-1978.

Maxwell, R. 1984. Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1977-1978 Jarvis Creek-Morkill River Area.

Climate information for the Study Area is also available from the Air Studies Branch of the British Columbia Ministry of Environment.

1.3 METHODS

The field data was collected during the summerof 1977 using standard field inventory methodology as developed by the Resource Analysis Branch (van Barneveld, 1976; Walmsley *et al.*, 1977).

Vegetation releves (sample plots) of both climax and successional vegetation were completed using the Vegetation Data Forms (V.F.S. Second Draft - January 1976). The nomenclature of plant species identified follows that of Taylor and MacBryde (1977) for vascular plants, Crum *et al.* (1973) for mosses, Hale and Culberson (1970) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts. A list of the plant species found in the Southeast Extension Study Area has been published in Northeast Coal Study Area, 1977-1978: A List of Vascular Plant Species (Ceska, 1979).

A total of 256 sites were sampled during the 1977 field program. The vegetation data from these releves was analyzed using the vegetation classification package called COENOS 1. Analysis of the 1977 field season vegetation plots resulted in the delineation of 28 vegetation types.

Additional information on sampling and vegetation analysis methods is given in Vegetation Resources of the Northeast Coal Study Area 1976-1977 (Harcombe, 1978).

CHAPTER TWO
REGIONAL VEGETATION

2.1 FOREST REGIONS, SECTIONS, ZONES AND SUBZONES

The macroclimatic variations discussed in the climate section of Chapter One are reflected in the three forest regions which occur in the Study Area (Figure 2.1).

The Boreal Region occurs on the east side of the Rocky Mountains and is influenced, in the summer, by westerly flowing air masses which have lost much of their moisture on their way over the mountains and, in winter, by the cold Arctic air masses.

The Subboreal Region, which straddles the Rocky Mountains and also occurs on their western slopes, is directly influenced by the westerly air masses which release large quantities of moisture in the form of rain or snow as they are forced over the mountains. The Subboreal Region is also susceptible to the influence of the cold Arctic air masses in winter.

The Interior Wet Belt Region has a wetter and milder climate than either the Boreal or Subboreal Regions. It, like the Subboreal Region, is influenced by the westerly flowing air masses but is less influenced by the cold Arctic air masses than is the Subboreal Region.

Each region of the Study Area is subdivided into sections which reflect climatic variations within each region and which are defined by characteristic sequences of zones and subzones on vertical (altitudinal) transects (Dawson, in progress).

Each zone within a section is defined as the area over which the climatic climax potential is constant. Forest zones represent areas over which certain shade tolerant tree species tend to become dominant if disturbance of the vegetation does not occur (Lea, 1984). Usually, the lowest-elevation forest zone within a region is considered a reflection of the forest macroclimate of that region.

A comparison of the Terrestrial Studies Branch classification of the Study Area to subzone level with the British Columbia Ministry of Forests classification of the Study Area is shown in Table 2.1. It should be noted that this is a general comparison and that the British Columiba Ministry of Forests classification is incomplete at present for some parts of the Study Area.

2.2 BOREAL REGION

The Boreal Forest Region occurs in the north eastern section of the Southeast Extension Study Area where it is restricted to the Rocky Mountain Foothills. It is fairly small in size and is characterized by the Boreal white spruce zone at low elevations and the Subalpine Englemann spruce - Alpine fir zone at higher elevations. Winters in this region are very cold, precipitation is limited and the growing season is short (ELUSC, 1978). The only section represented in the Boreal Region of the Study Area is the Wapiti Section.

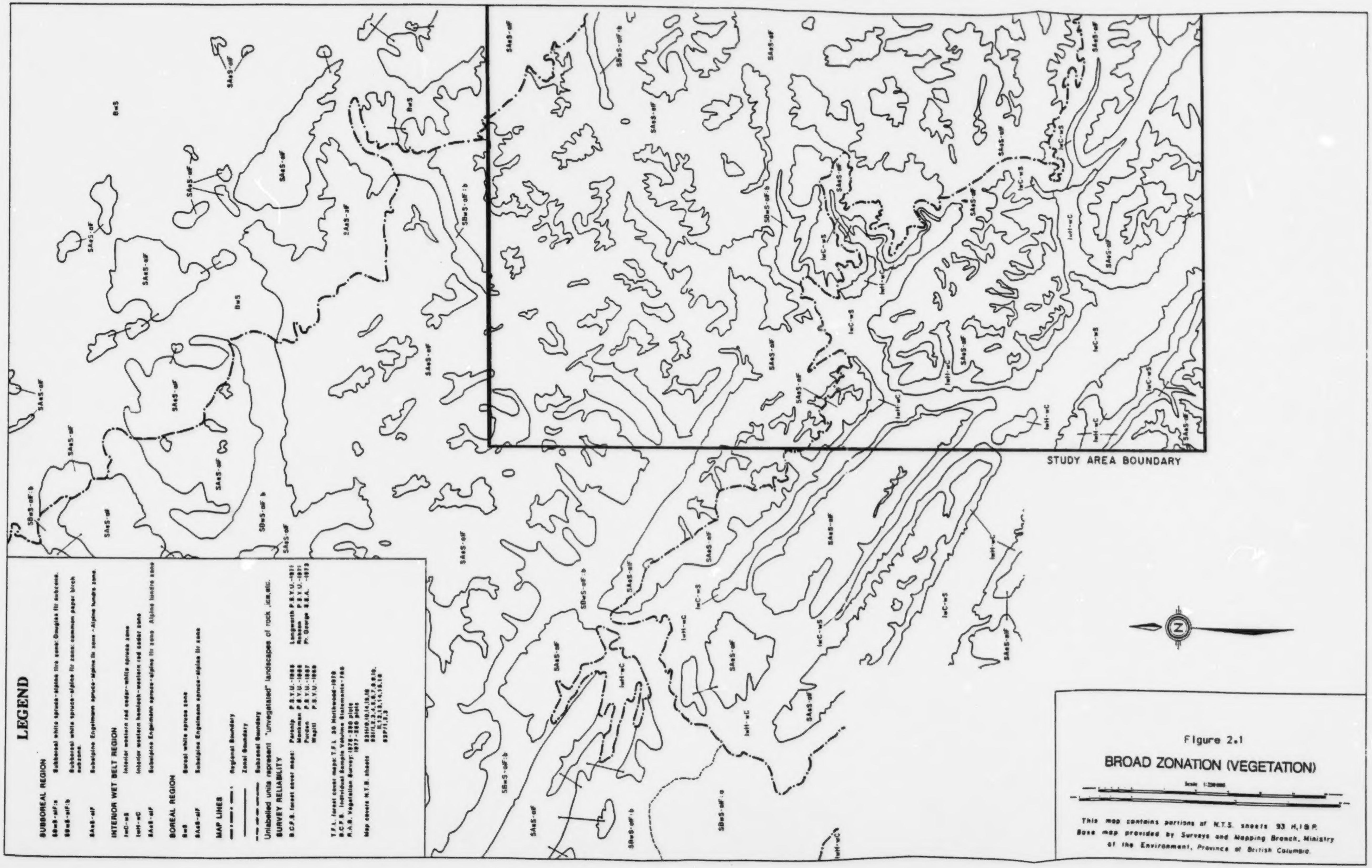
LEGEND
SUBBOREAL REGION
SBwS-alF:a Subboreal white spruce-alpine fir zone: Douglas fir subzone.
SBwS-alF:b Subboreal white spruce-alpine fir zone: common paper birch subzone.
SAeS-alF Subalpine Engelmann spruce-alpine fir zone - Alpine tundra zone.
INTERIOR WET BELT REGION
IwC-wS Interior western red cedar-white spruce zone
IwH-wC Interior western hemlock-western red cedar zone
SAeS-alF Subalpine Engelmann spruce-alpine fir zone Alpine tundra zone
BOREAL REGION
BwS Boreal white spruce zone
SAeS-alF Subalpine Engelmann spruce-alpine fir zone
MAP LINES
Regional Boundary
Zonal Boundary
Subzonal Boundary
Unlabelled units represent "unvegetated" landscapes of rock, ice, etc.
SURVEY RELIABILITY
B.C.F.S. forest cover maps: Parsnip P.S.Y.U.-1968 Monkman P.S.Y.U.-1968 Purden P.S.Y.U.-1967 Wapiti P.S.Y.U.-1969 Longworth P.S.Y.U.-1971 Robson P.S.Y.U.-1971 Pr. George S.B.A. -1973
T.F.L. forest cover maps: T.F.L. 30 Northwood-1970
B.C.F.S. Individual Sample Volume Statements-700
R.A.B. Vegetation Survey: 1976-200 plots 1977-280 plots
Map covers N.T.S. sheets 93H/9,10,14,15,16 93I/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16 93P/1,2,3
STUDY AREA BOUNDARY
N
SAeS-alF
SBwS-alF:b
SBwS-alF:a
BwS
IwC-wS
IwH-wC
Scale 1:250000

Figure 2.1

BROAD ZONATION (VEGETATION)

This map contains portions of N.T.S. sheets 93 H, I & P. Base map provided by Surveys and Mapping Branch, Ministry of the Environment, Province of British Columbia.

TABLE 2.1: A COMPARISON OF THE BIOPHYSICAL CLASSIFICATION BY THE TERRESTRIAL STUDIES BRANCH WITH THE BIOGEOCLIMATIC CLASSIFICATION BY THE BRITISH COLUMBIA MINISTRY OF FORESTS

FOREST REGION	SECTION	BIOPHYSICAL ZONE (B.C.M.E.)	BIOPHYSICAL SUBZONE (B.C.M.E.)	BIOGEOCLIMATIC ZONE[5] (B.C.M.F.)	BIOGEOCLIMATIC SUBZONE[5] (B.C.M.F.)
BOREAL	WAPITI	Boreal White Spruce [up to 1130 m (3700 ft)]	black spruce	Boreal White and Black Spruce[4] (BWBS)	No classification to date.
		Subalpine Engelmann Spruce - Alpine Fir [1130-1700 m (3700-5600 ft)]	a. forested b. krummholz	Engelmann Spruce - Subalpine Fir[4] (ESSF)	No classification to date.
		Alpine Tundra (not present in Study Area)		Alpine Tundra[4] (AT)	No classification to date.
SUB-BOREAL	PARSNIP	Subboreal White Spruce - Alpine Fir [up to 1300 m (4250 ft)]	a. Rocky Mountain Douglas-fir b. common paper birch	Subboreal Spruce[4] (SBS)	No classification to date.
		Subalpine Engelmann Spruce - Alpine Fir [1100-1800 m (3600-6000 ft)]	a. forested [1100-1600 m (3600-5200 ft)] b. krummholz [1600-1800 m (5200-6000 ft)]	Engelmann Spruce - Subalpine Fir (ESSF) [1220-1800 m (4000-6000 ft)]	a. forested ESSFn[1] - Wet Rocky Mountain Forested ESSF [1220 - 1660 m (4000 -5500 ft)] b. parkland ESSFnp[1] - Wet Rocky Mountain Parkland ESSF [1660 - 1800 m (5500-6000 ft)]
		Alpine Tundra [above 1800 m (6000 ft)]		Alpine Tundra (AT) [1800 m + (6000 ft+)]	

TABLE 2.1: (CONTINUED)

FOREST REGION	SECTION	BIOPHYSICAL ZONE (B.C.M.E.)	BIOPHYSICAL SUBZONE (B.C.M.E.)	BIOGEOCLIMATIC ZONE[5] (B.C.M.F.)	BIOGEOCLIMATIC SUBZONE[5] (B.C.M.F.)
SUB-BOREAL (Cont'd)	WILLOW RIVER	Subboreal White Spruce - Alpine Fir [up to 1300 m (4250 ft)]	a. Rocky Mountain Douglas-fir b. common paper birch	Subboreal Spruce[4] (SBS)	No classification to date.
		Subalpine Engelmann Spruce - Alpine fir [1100-1800 m (3600-6000 ft)]	a. forested [1100-1600 m (3600-5200 ft)] b. krummholz [1600-1800 m (5200-6000 ft)]	Engelmann Spruce - Subalpine Fir (ESSF) [1200-1800 m (4000-6000 ft)]	a. forested ESSFn[1] [1220-1660 m (4000-5500 ft)] b. Parkland ESSFnp[1] [1660-1800 m (5500-6000 ft)]
		Alpine Tundra [above 1800 m (6000 ft)]		Alpine Tundra (AT) [1800 m+ (6000 ft+)]	
INTERIOR WET BELT	McBRIDE	Interior Western Red Cedar - White Spruce [up to 800 m (2600 ft)]		Subboreal Spruce (SBS)	SBSf - Wet Rocky Mountain SBS [to 760 m] SBSg - Moist Rocky Mountain SBS [to 760 m] (SBSh[2] - Dry Rocky Mountain SBS)
				Interior Cedar Hemlock (ICH)	ICHf[3] - Very Wet Northern ICH ICHk[3] - Wet Northern ICH
		Interior Western Hemlock - Western Red cedar [up to 1100-1300 m (3600-4250 ft)]		Interior Cedar Hemlock (ICH)	ICHf[3] - Very Wet Northern ICH ICHk[3] -Wet Northern ICH (ICHj[2] - Moist Northern ICH)

TABLE 2.1: (CONTINUED)

FOREST REGION	SECTION	BIOPHYSICAL ZONE (B.C.M.E.)	BIOPHYSICAL SUBZONE (B.C.M.E.)	BIOGEOCLIMATIC ZONE[5] (B.C.M.F.)	BIOGEOCLIMATIC SUBZONE[5] (B.C.M.F.)
INTERIOR WET BELT (Cont'd)	McBRIDE (Cont'd)	Subalpine Engelmann Spruce - Alpine Fir [1100-1800 m (3600-6000 ft)]	a. forested b. krummholz	Engelmann Spruce - Subalpine Fir (ESSF) [1200-1800 m (4000-6000 ft)]	a. forested ESSFo[1] + ESSFn[1] - Moist Rocky Mountain Forested ESSF + Wet Rocky Mountain Forested ESSF [1220-1660 m (4000-5500 ft)] b. parkland ESSFop + ESSFnp - Moist Rocky Mountain Parkland ESSF + Wet Rocky Mountain Parkland ESSF [1660-1800 m (5500-6000 ft)]
		Alpine Tundra [above 1800 m (6000 ft)]		Alpine Tundra (AT) [1800 m+ (600 ft+)]	

[1] Elevations for the ESSF subzones are approximate as they are based on a preliminary, unpublished subzone map. The ESSFo is drier than the ESSFn, as is the ESSFop when compared to the ESSFnp.

[2] SBSh + ICHj are present from McBride south.

[3] ICH subzones occur from 760 - 1220 m (2500 - 4000 ft) above sea level. (Possibly occur to 1370 m (4500 ft) on south aspects).

[4] These areas have not been studied, to date, by the British Columbia Ministry of Forests; Zonal classification follows Krajina (1969).

[5] Based on unpublished information provided by D. Meidinger, British Columbia Ministry of Forests, Research Branch.

2.2.1 BOREAL WHITE SPRUCE ZONE

The Boreal white spruce zone is the lowest zone of the Boreal Region and is present up to about 1130 metres (3700 ft) above sea level. It is defined as having the potential for a white spruce climatic climax forest with alpine fir being absent (Harcombe, 1978). As the Boreal white spruce zone occurs largely on generally rolling topography, aspect appears to have little influence. For this reason, the plant communities are relatively uniform with the major sources of differentiation resulting from differences in soil substrate characteristics (ELUSC, 1978). The zonal white spruce climax is expected to occur on morainal or colluvial deposits.

The Boreal white spruce zone is represented by a single subzone - the black spruce subzone. Black spruce commonly occurs under lodgepole pine stands and is expected to form an edaphic climax on coarse-textured materials with low pH and poor nutrient status (ELUSC, 1978). Black spruce is also found to occur with tamarack on organic soils.

2.2.2 SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

In the Boreal Region the Subalpine Engelmann spruce - alpine fir zone generally occurs between 1130 and 1700 metres (3700 to 5600 ft) above sea level. The tree layer of the climax forests within this zone is made up of alpine fir and Engelmann spruce while the common shrub species in this zone include black blueberry and white-flowered rhododendron. The herb layer commonly contains Sitka valerian, broad-leaved arnica and green false hellebore. White-flowered rhododendron and alpine fir are reliable indicator species of the subalpine areas in the Boreal Region.

Two subzones are distinguishable in the Subalpine Engelmann spruce - alpine fir zone. These include:

1) a forested subzone at lower elevations; and,
2) a krummholz subzone at higher elevations. The division of the zone into these two subzones is based on physiognomic differences in tree growth. The krummholz subzone is characterized by clumps of stunted alpine fir and Engelmann spruce interspersed with open tundra (ELUSC, 1978). The forested subzone is characterized by somewhat dense, closed forests. Subalpine meadows are common in this zone and usually develop on wetter soils.

The Subalpine Engelmann spruce - alpine fir zone is relatively consistent throughout all regions of the Study Area and is also fairly extensive throughout the Study Area.

2.2.3 ALPINE TUNDRA ZONE

This zone is not present within the Boreal Region of the Southeast Extension Study Area (ELUSC, 1978).

2.3 SUBBOREAL REGION

The Subboreal Region of the Study Area occurs in the Rocky Mountain Foothills, in the western and northern parts of the Rocky Mountains and in the northern parts of both the Rocky Mountain Trench and the McGregor Plateau (ELUSC, 1978). Two sections are represented in this region of the study area, the Parsnip Section and the Willow River Section. The Subboreal Region is characterized by the Subboreal white spruce - alpine fir zone but also includes the Subalpine Engelmann spruce - alpine fir zone and the Alpine tundra zone.

2.3.1 SUBBOREAL WHITE SPRUCE - ALPINE FIR ZONE

The Subboreal white spruce - alpine fir zone occupies the lowest elevations of the Subboreal Region, occurring only below 1300 metres (4250 feet) above sea level. The dominant tree species of the climatic climax forests of this zone include alpine fir and white spruce (or a hybrid of white and Engelmann spruce). The shrub species commonly include western thimbleberry and blueberries while the herb layer commonly contains Canadian bunchberry, five-leaved creeping raspberry, simple-stemmed twistedstalk and oak fern.

Two subzones have been determined within this zone on the basis of potential differences in seral components. They include:

a. the Rocky Mountain Douglas-fir subzone which is present in areas where Rocky Mountain Douglas-fir is a potential seral tree species on medium-textured soils. This subzone reflects the influence of the drier and warmer climate of the Dry Interior Forest Region to the south. The Rocky Mountain Douglas-fir subzone is present only in lower parts of the Fraser and McGregor River valleys and is limited in extent in the Study Area.

b. the common paper birch subzone which is found in valley bottoms on both sides of the Rocky Mountains (ELUSC, 1978). The climate of this subzone is cooler and wetter than the Rocky Mountain Douglas-fir subzone due to the fact that it experiences more Arctic air intrusions and has slightly greater precipitation. The common paper birch subzone is much more common in the Study Area than is the Rocky Mountain Douglas-fir subzone. Rocky Mountain Douglas-fir is absent as a potential seral tree species on medium-textured soils but may occur where edaphic conditions such as shallow soil or south aspect are present.

2.3.2 SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

This zone is present at elevations from 1100 to 1800 metres (3600 to 6000 ft) above sea level in the Study Area. The boundary between the forested subzone and the krummholz subzone is located at approximately 1600 metres (5200 ft) elevation above sea level.

The dominant floristic composition of this zone is very similar to that of its counterpart in the Boreal Region.

2.3.3 ALPINE TUNDRA ZONE

This zone is fairly common in the Rocky Mountains and Rocky Mountain Foothills of the Subboreal Region and is present at elevations above 1800 metres (6000 ft) above sea level.

The tundra-like vegetation of this zone is characteristically dominated by dwarf shrubs such as dwarf blueberry and net-leaved dwarf willow and by herbs such as alpine-azalea, four-angled cassiope, Mertens' cassiope, both red and cream mountain-heather, entire-leaved white mountain-avens and white mountain-avens.

The most important factor determining the floristic composition of alpine plant communities appears to be the soil parent materials with acidic parent materials tending to support dwarf blueberry and alpine-azalea and basic bedrock tending tosupport entire-leaved white mountain-avens and netleaved dwarf willow (ELUSC, 1978).

In addition to soil parent materials, microclimatic factors such as wind exposure, solar radiation, snow accumulation, and geomorphological processes such as cryoturbation, solifluction and nivation also exert a strong influence on the composition and variation of plant communities (ELUSC, 1978).

2.4 INTERIOR WET BELT REGION

The Interior Wet Belt Region is present in the southern and southeastern portions of the Rocky Mountains, the McGregor Plateau and the Rocky Mountain Trench (ELUSC, 1978). In this region, the McBride Section is the only section which is represented in the Study Area. It is characterized by the interior western red cedar - white spruce zone and by the interior western hemlock - western red cedar zone. Also present in this region are the Subalpine Engelmann spruce - alpine fir zone and the Alpine tundra zone.

2.4.1 INTERIOR WESTERN RED CEDAR - WHITE SPRUCE ZONE

This zone is confined to valley bottoms in the Interior Wet Belt and is very similar floristically to the Subboreal white spruce - alpine fir zone. White spruce and alpine fir make up the tree layer of the climatic climax of this zone with western red cedar present as a significant constituent. The presence of western red cedar in significant amounts is probably the result of considerable amounts of rainfall occurring in the valley bottoms of the Interior Wet Belt Region. Western hemlock is most likely eliminated from this zone by the advective and radiation frosts which frequently occur in the valley bottoms at elevations below 800 metres (2600 feet) above sea level (ELUSC, 1978). The shrub layer of this zone is dominated by devil's-club and western thimbleberry while the herb layer commonly includes Canadian bunchberry, wild sarsaparilla and simple-stemmed twistedstalk.

2.4.2 INTERIOR WESTERN HEMLOCK - WESTERN RED CEDAR ZONE

This zone is characteristic of low elevations in the Interior Wet Belt Region and ranges in elevation from 800 to about 1300 metres (2600 to 4250 ft) above sea level (ELUSC, 1978) in the Study Area.

The tree layer of the climatic climax of this zone includes western hemlock, western red cedar, white spruce and alpine fir. The shrub layer of the interior western hemlock - western red cedar zone characteristically includes devil's-club, black blueberry and oval-leaved blueberry while the herb layer commonly includes Canadian bunchberry, few-flowered wintergreen, oak fern, unifoliate-leaved foamflower and five-leaved creeping raspberry.

2.4.3 SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

The Subalpine Engelmann spruce - alpine fir zone of the Interior Wet Belt Region is present at elevations ranging from 1100 to 1800 metres (3600 to 6000 ft) above sea level. The vegetation composition of this zone is very similar to that of the same zone in both the Boreal Region and the Subboreal Region. In addition, extensive alder stands are present in this zone which result from the occurrence of avalanches and the subsequent lowering of the timberline. High snowfalls and deep snowpacks in this zone also result in substantial tree damage and a corresponding overgrowth of shrubs (ELUSC, 1978).

2.4.4 ALPINE TUNDRA ZONE

This zone is present at elevations greater than 1800 metres (6000 ft) above sea level.

The floristic composition of this zone is very similar to the same zone of the Subboreal Region.

CHAPTER THREE
VEGETATION TYPES

As is mentioned in Section 1.3 of this report, twenty-eight vegetation types were delineated with the use of COENOS 1 (Table 3.1). These twenty-eight types are described in the Vegetation Characteristics Tables 3.2 through 3.29 as well as in the following pages.

It should be noted that the twenty-eight vegetation types which are described in this report are based on vegetation and soils data collected during the 1977 field season. The types described may not represent all possible vegetation types which occur in the Study Area.

Vegetation types are strongly related to soil drainage which is partially reflected in soil development but is more directly correlated with soil texture and slope position. The relationship of each vegetation type to soil and environmental characteristics are shown in Tables 3.2 to 3.29. The soil and environment data for each plot within each vegetation type is listed in Appendix C. The soil association components listed for each vegetation type may not encompass all possible components upon which each vegetation type may occur.

Description of the soil association components and the soils of the study area are given in Maxwell (1982).

TABLE 3.1: LIST OF VEGETATION TYPE NAMES

Number	Name
1	Net-leaved dwarf willow - entire-leaved white mountain-avens (white mountain avens) (Table 3.2)
2	Net-leaved dwarf willow - moss campion - boreal mugwort (Table 3.3)
3	Mertens' cassiope - cream mountain-heather - *Cetraria* spp. (Table 3.4)
4	Mertens' cassiope - black alpine sedge - *Barbilophozia floerkei* (Table 3.5)
5	Sitka valerian - showy sedge - green false hellebore (Table 3.6)
6	Willow spp. - sedge spp. - white marshmarigold - tufted deer-grass (Table 3.7)
7	Engelmann spruce - common juniper - goldenrod spp. (Table 3.8)
8	Alpine fir - black blueberry - red mountain-heather - Mertens' cassiope (Table 3.9)
9	Lodgepole pine - Pacific menziesia - red mountain-heather (Table 3.10)
10	Alpine fir - black blueberry - white-flowered rhododendron - Sitka valerian - broad-leaved arnica (Table 3.11)
11	Alpine fir - white-flowered rhododendron - oak fern - five-leaved creeping raspberry (Table 3.12)
12	Engelmann spruce (X white spruce) - black blueberry - broad-leaved arnica - five-leaved creeping raspberry (Table 3.13).
13	Engelmann spruce - black swamp gooseberry - five-leaved creeping raspberry - green false hellebore (Table 3.14).
14	White spruce - twinberry honeysuckle - Canadian bunchberry - northern twinflower (Table 3.15)
15	Bog willow - bog glandular birch - water sedge - *Sphagnum* spp. (Table 3.16)
16	White spruce X Engelmann spruce - alpine fir - black swamp gooseberry - oak fern (Table 3.17)
17	Bog willow - Sitka sedge - *Brachythecium* sp. (Table 3.18)
18	Lodgepole pine - velvet-leaved blueberry - Canadian bunchberry (Table 3.19)
19	White spruce - alpine fir - devil's-club - oak fern - unifoliate-leaved foamflower (Table 3.20)
20	White spruce - common paper birch - twinberry honeysuckle - red-osier dogwood - dwarf red blackberry (Table 3.21)
21	White spruce - lodgepole pine - soopolallie - rough-leaved rice grass - northern twinflower (Table 3.22)
22	Lodgepole pine - common Labrador tea - bog cranberry (Table 3.23)
23	Hoary sedge - hemlock water-parsnip (Table 3.24)
24	Western hemlock - western red cedar - devil's-club - black blueberry - oak fern - Canadian bunchberry (Table 3.25)
25	Western hemlock - western red cedar - oval-leaved blueberry - Canadian bunchberry - five-leaved creeping raspberry (Table 3.26)
26	Rocky Mountain Douglas-fir - western red cedar - western hemlock - common western pipsissewa - many-flowered one-sided wintergreen (Table 3.27)
27	Common paper birch - Sitka willow - birch-leaved spirea - Douglas' aster (Table 3.28)
28	Lodgepole pine - black spruce - bog glandular birch - bog cranberry - narrow-leaved cotton-grass (Table 3.29)

3.1 ALPINE TUNDRA ZONE

Types 1 to 4 represent four different alpine tundra vegetation types. They may be found in all regions of the Southeast Extension Study Area where alpine tundra occurs.

VEGETATION TYPES OF THE ALPINE TUNDRA ZONE

Number	Name
1	Net-leaved dwarf willow - entire-leaved white mountain-avens (white mountain-avens) [Table 3.2]
2	Net-leaved dwarf willow-moss campion-boreal - boreal mugwort [Table 3.3]
3	Mertens' cassiope - cream mountain-heather - *Cetraria* spp. [Table 3.4]
4	Mertens' cassople - black alpine sedge - *Barbilophozia floerkei* [Table 3.5]

For the most part, these types occur at elevations about 1800 metres (6000 ft) above sea level. However, both 3 and 4 are reported to occur at elevations below 1800 metres (6000 ft). This is probably due to the fact that, at lower elevations, these types occur on northerly aspects where temperatures are cooler than in the surrounding area and snow accumulation is greater and remains for longer periods.

Trees and shrubs are absent in all types of the Alpine tundra zone which were sampled. Types 1 to 3 are representative of maturing climax communities (each of which may be representative of a maturing climatic climax community in a specific region of the study area) while type 4 represents a maturing edaphic climax community.

All of the alpine tundra types are present on colluvial materials with type 4 also present on morainal materials. Four soil associations occur in the alpine tundra of the study area (Maxwell, 1984). These include Gable Mountain Association (GM), Menagin Association (MN), Teare Mountain Association (TE) and Reesor Association (RR). The soils of type 1 are mainly Brunisols, those of type 2 are primarily Regosols, type 3 has Brunisols, Podzols and Regosols, and type 4 soils consist of Podzols, Brunisols and Luvisols.

3.2 SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE: KRUMMHOLZ SUBZONE

Types 5 to 8 represent four different vegetation types of the Subalpine Engelmann Spruce - alpine fir zone: krummholz subzone. The elevations of these types range from 1130 to 1900 metres 3700 to 6200 ft).

VEGETATION TYPES OF THE KRUMMHOLZ SUBZONE OF THE SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

Number	Name
5	Sitka valerian - showy sedge - green false hellebore (Table 3.6)
6	Willow spp. - sedge spp. - white marsh - marigold - tufted deer-grass (Table 3.7)
7	Engelmann spruce - common juniper - goldenrod spp. (Table 3.8)
8	Alpine fir - black blueberry - red mountain-heather - Mertens' cassiope (Table 3.9)

Types 5 and 6 are subalpine meadow communities with trees and tall shrubs being absent in both. In addition, low shrubs are absent in type 5 but are present with low cover in type 6. Both of these types represent maturing edaphic climax communities and are most likely to occur where snow accumulation is high and where the soil remains wet for relatively long periods in the spring.

Types 7 and 8 are krummholz types with type 7 representing overmature seral vegetation and type 8 representing the maturing climatic climax vegetation of the Krummholz Subzone. Both types are characterized by clumps of stunted trees and open tundra. They occur primarily on southerly aspects where milder climatic conditions have allowed the growth of hardy tree species such as alpine fir and Engelmann spruce. Both types 7 and 8 have drier moisture regimes than types 5 and 6. Types 5, 7, and 8 occur primarily on culluvial materials although they also occur on fluvial and morainal materials. Type 6, however, occurs primarily on organic materials. Various soil association components occur within the Krummholz subzone and these are listed in Tables C-5 to C-8. The soils of type 5 are mainly Podzols, those of type 6 are primarily Gleysols with Podzols and organics also present, type 7 soils are mainly calcareous Regosols and the soils of type 8 are variable including Podzols, Regosols and Brunisols.

3.3 SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE: FORESTED SUBZONE

In general, the seven types representing the forested subzone of the Subalpine Engelmann spruce - alpine fir zone occur at lower elevations than do the four types of the krummholz subzone. The elevational range of the forested subzone types is from 930 to 1860 metres (3050 to 6100 ft). The climate of these seven types is also considerably milder than either the climate of the Alpine tundra zone or the climate of the krummholz subzone.

VEGETATION TYPES OF THE FORESTED SUBZONE OF THE SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

Number	Name
9	Lodgepole pine - Pacific menziesia - red mountain-heather (Table 3.10)
10	Alpine fir - black blueberry - white-flowered rhododendron - Sitka valerian - broad-leaved arnica (Table 3.11)
11	Alpine fir - white-flowered rhododendron - oak-fern - five-leaved creeping raspberry (Table 3.12)
12	Engelmann spruce (X white spruce) - black blueberry - broad-leaved arnica - five-leaved creeping raspberry (Table 3.13)
13	Engelmann spruce - black swamp gooseberry - five-leaved creeping rasberry - green false hellebore (Table 3.14)
14	White spruce - twinberry honeysuckle - Canadian bunchberry - northern twinflower (Table 3.15)
15	Bog willow - bog glandular birch - water sedge - Sphagnum spp. (Table 3.16)

Type 9 represents mature seral vegetation of the forested subzone, types 10 to 14 represent maturing climax vegetation (each of which may be representative of maturing climatic climax vegetation in a specific region of the Study Area) and type 15 is representative of maturing edaphic climax vegetation.

Various soil association components occur within the forested subzone and these are listed in Tables C-9 to C-15. The soils of types 9 to 13 are primarily Podzols and Luvisols, those of type 14 are primarily Regosols, and the soils of type 15 are mainly organic Fibrisols.

3.4 SUBBOREAL REGION -SUBBOREAL WHITE SPRUCE - ALPINE FIR ZONE: COMMON PAPER BIRCH SUBZONE

Although the Subboreal Region is a major vegetation component of the Study Area, it is only represented here by two types. This is due to a lack of adequate sampling of this region. Additional types are described for the Core Area in Harcombe (1978).

Types 16 and 17 occur at elevations between 910 and 1200 metres (2990 - 3940 ft).

VEGETATION TYPES OF THE COMMON PAPER BIRCH SUBZONE OF THE SUBBOREAL WHITE SPRUCE - ALPINE FIR ZONE

Number	Name
16	White spruce X Engelmann spruce - alpine fir - black swamp gooseberry - oak fern (Table 3.17)
17	Bog willow - Sitka sedge - Brachythecium sp. (Table 3.18).

Type 16 represents the maturing climatic climax of the Subboreal Region of the Study Area while type 17 is representative of the maturing edaphic climax. These two types are included in the common paper birch subzone because of a lack of Rocky Mountain Douglas-fir in the tree and shrub layers. Although the Rocky Mountain Douglas-fir subzone is present in a limited portion of the Study Area, no vegetation types are mentioned here as being representative of the subzone as it was not sampled during the 1977 field season.

Five soil association components occur in the Subboreal Region of the Study Area. These include: the Bowron soil association (BO), the Dudzic soil association (DC), the Holliday soil association (HL), the Forgetmenot soil association (FG), and the Knudsen Creek soil association (KN). The soils of type 16 are primarily Luvisols and Podzols while those of type 17 are Gleysols.

3.5 BOREAL REGION - BOREAL WHITE SPRUCE ZONE: BLACK SPRUCE SUBZONE

The Boreal Region occurs in the extreme northeastern corner of the Study Area and is represented here by type 18. Other types may be present but only vegetation of type 18 was sampled (additional types are described for the Core Area in Harcombe (1978)).

VEGETATION TYPES OF THE BLACK SPRUCE SUBZONE OF THE BOREAL WHITE SPRUCE ZONE

Number	Name
18	Lodgepole pine - velvet-leaved blueberry - Canadian blueberry (Table 3.19)

Type 18 is representative of young to maturing seral vegetation and is present on fluvial materials at elevations between 1110 and 1200 metres (3640-3940 ft).

Two soil association components occur in type 18. These include the Ovington Creek soil association (OV) and the Holtslander soil association (HO). The soils of this type are typically sandy podzols.

3.6 INTERIOR WET BELT REGION - INTERIOR WESTERN RED CEDAR - WHITE SPRUCE ZONE

The interior western Red Cedar - white spruce zone is represented in the Study Area by five types. These types range in elevation from 610 to 810 metres (2000-2660 ft).

VEGETATION TYPES OF THE INTERIOR WESTERN RED CEDAR - WHITE SPRUCE ZONE

Number	Name
19	White spruce - alpine fir - devil's club - oak fern - unifoliate-leaved foamflower (Table 3.20)
20	White spruce - common paper birch - twinberry honeysuckle - red-osier dogwood - dwarf red blackberry (Table 3.21)
21	White spruce - lodgepole pine - soopolallie - rough-leaved rice grass - northern twinflower (Table 3.22)
22	Lodgepole pine - Common Labrador tea - bog cranberry (Table 3.23)
23	Hoary sedge - hemlock water-parsnip (Table 3.23)

Type 19 represents maturing climatic climax vegetation, type 20 represents overmature seral vegetation, type 21 represents mature seral vegetation, and types 22 and 23 are representative of maturing edaphic climax vegetation of the interior western red cedar - white spruce zone.

This zone is represented in the Study Area by seven soil association components. These include: the Longworth soil association (LO), the Ptarmigan soil association (PM), the Fontoniko Creek soil association (FN), the Guilford soil association (GF), the Raush soil association (RH), the Lanezi soil association (LZ), and the Catfish Creek soil association (CC). The Longworth soil association is the dominant soil association component of the five vegetation types of this zone and is present in all of the types. Type 19 occurs primarily on sandy Podzols which are present on fluvial terraces. The soils of type 20 are variable and, like type 19, are mostly sandy in texture, occurring on fluvial materials. Type 21 soils are Podzols and Brunisols with a sandy texture and are primarily present on fluvial and glaciofluvial materials. The soils of types 22 and 23 are organic.

All types are present on mainly level valley floors to lower slopes and, with the exception of types 22 and 23, have predominantly mesic moisture regimes and occur on well drained materials. Types 22 and 23 are subhydric and predominantly occur on very poorly drained materials.

All of the types lack western hemlock in the tree and shrub layers. As has been mentioned earlier in the text, this is probably due to the frequent occurrence of advective and radiation frosts which occur at the lower elevations of this zone.

3.7 INTERIOR WET BELT REGION - INTERIOR WESTERN HEMLOCK - WESTERN RED CEDAR ZONE

The interior western hemlock - western red cedar zone is represented by five types in the Study Area.

These types range in elevation from 710 to 1290 metres (2330-4230 ft).

VEGETATION TYPES OF THE INTERIOR WESTERN HEMLOCK - WESTERN RED CEDAR ZONE

Number	Name
24	Western hemlock - western red cedar - devil's - club - black blueberry - oak fern - Canadian bunchberry (Table 3.25)
25	Western hemlock - western red cedar - oval-leaved blueberry - Canadian bunchberry - five-leaved creeping raspberry (Table 3.26)
26	Rocky Mountain Douglas-fir - western red cedar - western hemlock - common western pipsissewa - many-flowered one-sided wintergreen (Table 3.27)
27	Common paper birch - Sitka willow - birch-leaved spirea - Douglas' aster (Table 3.28)
28	Lodgepole pine - black spruce - bog glandular birch - bog cranberry - narrow-leaved cotton-grass (Table 3.29)

Types 24 and 25 represent maturing climax vegetation, type 26 represents overmature seral vegetation, type 27 represents young seral vegetation and type 28 is representative of maturing edaphic climax vegetation.

The interior western hemlock - western red cedar zone occurs on a variety of soil association components. The soils of type 24 are Podzols, Luvisols and Brunisols, those of type 25 are Podzols and Luvisols; Podzols dominate type 26 although Brunisols may also be present; type 27 has a variety of soils; and the soils of type 28 are predominantly organic Fibrisols.

The five types of this zone occur on a variety of slopes, aspects, drainage categories, and landforms. For the most part, they occur on lower slopes and have mesic moisture regimes (with the exception of type 28 which has a subhydric moisture regime and occurs on organic parent materials).

Generally speaking, types 24 to 28 occur at higher elevations than do types 19 to 23. These slightly higher elevations probably determine the presence of western hemlock as the climatic factors, terrain and soils, and topography appear to be very similar between the interior western red cedar - white spruce zone and the interior western hemlock - western red cedar zone.

TABLE 3.2: VEGETATION CHARACERISTICS OF VEGETATION TYPE 1

Type 1	Net-leaved dwarf willow - entire-leaved white mountain-avens (white mountain-avens)

VEGETATION CHARACTERISTICS

Region: Subboreal, Interior Wet Belt
Section: -

Zone: Alpine tundra
Subzone: -

Successional stage: Maturing Climax
Stand appearance: tundra

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (0)	-	-	-	-
Herb layer (50)	entire-leaved white mountain-avens (white-mountain-avens) net-leaved dwarf willow	20 (20) 10	arctic blue grass moss campion	1 5
Moss, lichen and liverwort layer (20)	Cetraria nivalis	2	Polytrichum piliferum	10

CHARACTER SPECIES

Present	Absent
net-leaved dwarf willow entire-leaved white mountain-avens (white mountain-avens) arctic blue grass Centraria nivalis	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial
Soil Texture: sandy loam to silt loam
Soil Association Comp: RR 1, 2, 11; TE 1

Moisture Regime: submesic
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1830-2090 m (6200-6850 ft)
Slope: 0 - 26°
Aspect: level to 226°
Landscape Position: upper slope

ECOLOGY

Major climatic factors which help to determine this type are solar radiation, wind exposure and snow accumulation, all of which tend to be extreme.

TABLE 3.3: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 2

Type 2	Net-leaved dwarf willow - moss campion - boreal mugwort

VEGETATION CHARACTERISTICS

Region: Subboreal, Interior Wet Belt
Section: -
Zone: Alpine tundra
Subzone: -

Successional stage: Maturing Climax
Stand appearance: tundra

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (0)	-	-	-	-
Herb layer (40)	moss campion boreal mugwort net-leaved dwarf willow	5 5 20	curved alpine wood-rush spiked wood-rush alpine bistort	1 1 5
Moss, lichen and liverwort layer (30)	*Polytrichum piliferum*	10	*Cetraria nivalis*	20

CHARACTER SPECIES

Present	Absent
net-leaved dwarf willow moss campion boreal mugwort curved alpine wood-rush spiked wood-rush alpine bistort *Polytrichum piliferum*	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial
Soil Texture: sand to loam
Soil Association Comp: TE 1; RR 2, 11; GM 4; MN 3, 4

Moisture Regime: subxeric to submesic
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1890-2160 m (6200-7080 ft)
Slope: 0 - 22°
Aspect: level to 230°
Landscape Position: upper slope to apex

ECOLOGY

The soils of this type are experiencing cryoturbation due to frost action. Extreme climatic conditions help to determine this type with the major climatic factors including solar radiation, wind exposure and snow accumulation.

TABLE 3.4: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 3

Type 3	Mertens' cassiope - cream mountain-heater - Cetraria spp.

VEGETATION CHARACTERISTICS

Region: Subboreal, Interior Wet Belt
Section: -
Zone: Alpine tundra
Subzone: -

Successional stage: Maturing Climax
Stand appearance: tundra

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (0)	-	-	-	-
Herb layer (60)	Mertens' cassiope cream mountain-heather	15 20	four-angled cassiope glaucous gentian	1 1
Moss, lichen and liverwort layer (35)	Cetraria spp.	5	Solorina crocea	2

CHARACTER SPECIES

Present	Absent
Mertens' cassiope cream mountain-heather glaucous gentian Centraria spp. Solorina crocea	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial
Soil Texture: sand to silt loam
Soil Association Comp: TE 2, 4; MN 1, 2, 4

Moisture Regime: submesic
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1730-2110 m (5680-6920 ft)
Slope: 0 - 15°
Aspect: level to 198°
Landscape Position: upper slope to apex

ECOLOGY

Extreme climatic conditions help to determine this alpine meadow type, the major climatic factors being solar radiation, wind exposure and snow accumulation.

TABLE 3.5: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 4

Type 4	Mertens' cassiope - black alpine sedge - *Barbilophozia floerkei*

VEGETATION CHARACTERISTICS

Region:	Subboreal, Interior Wet Belt	Zone:	Alpine tundra
Section:	-	Subzone:	-

Successional stage: Maturing Edaphic Climax
Stand appearance: tundra

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (0)	-	-	-	-
Herb layer (80)	Mertens' cassiope black alpine sedge	40 30	slender hawkweed broad-leaved arnica red mountain-heather	5 5 10
Moss, lichen and liverwort layer (30)	*Barbilophozia floerkei*	30	*Dicranum pallidisetum*	20

CHARACTER SPECIES

Present	Absent
Mertens' cassiope black alpine sedge slender hawkweed *Barbilophozia floerkei* *Dicranum pallidisetum*	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial, morainal
Soil Texture: sand to loam
Soil Association Comp: MN 2, 4; TE 1, 2, 4; RR 11; GM 3, 4

Moisture Regime: mesic to hygric
Drainage: well to imperfectly

TOPOGRAPHY

Elevation: 1540-2070 m (5050-6800 ft)
Slope: 2 - 20°
Aspect: 10 to 330°
Landscape Position: lower slope to upper slope

ECOLOGY

Type 4 appears to be a wetter type than Types 1, 2 or 3. This type is primarily determined by snow accumulation although wind exposure and solar radiation are also important. It is most likely found in areas where snow is slower to melt in the spring.

TABLE 3.6: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 5

Type 5	Sitka valerian - showy sedge - green false hellebore

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -

Zone: Subalpine Engelmann spruce - alpine fir
Subzone: krummholz

Successional stage: Maturing Edaphic Climax
Stand appearance: meadow

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (0)	-	-	-	-
Herb layer (100)	Sitka valerian showy sedge green false hellebore	20 40 10	boreal mugwort subalpine fleabane arrow-leaved ragwort	10 5 5
Moss, lichen and liverwort layer (10)	*Drepanocladus* spp.	20	*Tortula ruralis* *Polytrichum juniperinum*	5 2

CHARACTER SPECIES

Present	Absent
Sitka valerian showy sedge green false hellebore boreal mugwort subalpine fleabane arrow-leaved ragwort *Drepanocladus* spp.	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial, morainal
Soil Texture: sandy loam to silt loam
Soil Association Comp: TE 4; PK 1, 6; DZ 11

Moisture Regime: submesic to subhygric
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1190-1820 m (3900-5970 ft)
Slope: 2 - 15°
Aspect: 90 to 230°
Landscape Position: lower slope to upper slope

ECOLOGY

The climate is generally not as severe as in the Alpine tundra zone. Snow accumulation is a major factor which determines this subalpine meadow type.

TABLE 3.7: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 6

Type 6	Willow spp. - sedge spp. - white marsh-marigold - tufted deer-grass

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -
Zone: Subalpine Engelmann spruce - alpine fir
Subzone: krummholz

Successional stage: Maturing Edaphic Climax
Stand appearance: meadow

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (20)	willow spp.	20	-	-
Herb layer (90)	sedge spp. white marsh-marigold tufted deer-grass	40 5 40	leatherleaf saxifrage fringed grass-of-Parnassus sticky false asphodel	15 1 1
Moss, lichen and liverwort layer (10)	*Paludella squarrosus*	10	*Campylium stellatum* *Aulacomnium palustre*	1 60

CHARACTER SPECIES

Present	Absent
willow spp. sedge spp. white marsh-marigold tufted deer-grass fringed grass-of-Parnassus *Paludella squarrosus*	trees and shrubs

TERRAIN AND SOILS

Terrain: colluvial, fluvial and organic
Soil Texture: sand to sandy loam and organic
Soil Association Comp: HA 4; HK 8; HP 7; KN 8; NK 8; RR 1

Moisture Regime: subhygric to hygric
Drainage: imperfectly to poorly

TOPOGRAPHY

Elevation: 1360-1900 m (4460-6230 ft)
Slope: 0 - 9°
Aspect: level to 120°
Landscape Position: lower slope to upper slope

ECOLOGY

Type 6 is a subalpine meadow type characterized by wet soils, typically gleysols and organics. It is wetter than Type 5 but, like Type 5, appears to be determined by snow accumulation. The climate is generally not as severe as in the Alpine Tundra Zone.

TABLE 3.8: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 7

Type 7	Engelmann spruce - common juniper - goldenrod spp.

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -

Zone: Subalpine Engelmann spruce - alpine fir
Subzone: krummholz

Successional stage: Overmature Climax
Stand appearance: parkland

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (20)	Engelmann spruce	20	lodgepole pine	10
Low shrub layer (30)	common juniper soopolallie	5 5	willow spp.	1
Herb layer (40)	goldenrod spp. fringed grass-of-Parnassus	2 2	gentian spp.	1
Moss, lichen and liverwort layer (10)	*Rhacomitrium canescens*	5	-	-

CHARACTER SPECIES

Present	Absent
Engelmann spruce lodgepole pine common juniper soopolallie willow spp. goldenrod spp. fringed grass-of-Parnassus	trees

TERRAIN AND SOILS

Terrain: mostly fluvial
Soil Texture: sand
Soil Association Comp: RR 3; PX 10; HO 7

Moisture Regime: subxeric to submesic
Drainage: well

TOPOGRAPHY

Elevation: 1130-1810 m (3700-5940 ft)
Slope: 3 - 20°
Aspect: 30 to 246 °
Landscape Position: mostly middle slope

ECOLOGY

Table 7 is drier than types 5 and 6 and is found on calcareous soils. This type appears to be found primarily on the leeward side of the mountains and therefore can expect to be affected by warmer temperatures and a reduction in precipitation. Stunted trees result from certain climatic conditions (primarily wind exposure and snow accumulation) which are found at subalpine elevations.

TABLE 3.9: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 8

Type 8	**Alpine fir - black blueberry - red mountain-heather - Mertens' cassiope**

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -
Zone: Subalpine Engelmann spruce - alpine fir
Subzone: krummholz

Successional stage: Maturing Climatic Climax
Stand appearance: parkland

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (30)	alpine fir	30	Engelmann spruce	10
Low shrub layer (50)	alpine fir black blueberry	60 10	-	-
Herb layer (40)	red mountain-heather Mertens' cassiope	30 10	five-leaved creeping raspberry	10
Moss, lichen and liverwort layer (50)	*Barbilophozia floerkei*	10	*Dicranium pallidisetum* *Barbilophozia lycopodioides*	5 30

CHARACTER SPECIES

Present	Absent
alpine fir black blueberry red mountain-heather Mertens' cassiope *Barbilophozia floerkei*	trees

TERRAIN AND SOILS

Terrain: colluvial, fluvial and morainal
Soil Texture: sand to loam
Soil Association Comp: SM 3; DC 11; MN 1, 2; HP 3; HS 3; HL 3
Moisture Regime: submesic to mesic
Drainage: well

TOPOGRAPHY

Elevation: 1280-1890 m (4200-6200 ft)
Slope: 4 - 23°
Aspect: 128 to 360°
Landscape Position: upper slope

ECOLOGY

Type 8 occurs primarily on acidic bedrock. Certain climatic conditions such as wind exposures and snow accumulation result in stunted trees in this type. The soils of this type drain freely and hold low to moderate moisture. The soil surface horizons are usually very strongly acid.

TABLE 3.10: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 9

Type 9	Single Releve Lodgepole pine - Pacific menziesia - red mountain-heather

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -
Zone: Subalpine Engelmann spruce - alpine fir
Subzone: krummholz

Successional stage: Maturing Seral
Stand appearance: relatively closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (50)	lodgepole pine	50	whitebark pine alpine fir	1 1
Tall shrub layer (1)	Engelmann spruce lodgepole pine	1	-	-
Low shrub layer (60)	Pacific menziesia	40	black blueberry	20
Herb layer (20)	red mountain-heather	15	Canadian bunchberry ground-cedar	5 5
Moss, lichen and liverwort layer (30)	*Pleurozium schreberi*	20	*Dicranium pallidisetum* *Rhacomitrium canescens*	5 5

CHARACTER SPECIES

Present	Absent
lodgepole pine Pacific menziesia red mountain-heather Canadian bunchberry ground-cedar *Pleurozium schreberi*	trees

TERRAIN AND SOILS

Terrain: colluvial blanket/glaciofluvial terrace
Soil Texture: sand
Soil Association Comp: HL 2

Moisture Regime: subxeric
Drainage: well

TOPOGRAPHY

Elevation: 1540 m (5050 ft)
Slope: 26°
Aspect: 202°
Landscape Position: middle slope

ECOLOGY

The climate is not as severe as in the krummholz subzone and the presences of trees helps to moderate the climate as well.

TABLE 3.11: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 10

Type 10	Alpine fir - black blueberry - white-flowered rhododendron - Sitka valerian - broad-leaved arnica

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -

Zone: Subalpine Engelmann spruce - alpine fir
Subzone: forested

Successional stage: Maturing Seral
Stand appearance: open coniferous forests

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (20)	alpine fir	15	Engelmann spruce	5
Tall shrub layer (5)	alpine fir	5	-	-
Low shrub layer (30)	black blueberry white-flowered rhododendron	10 20	oval-leaved blueberry	5
Herb layer (50)	broad-leaved arnica Sitka valerian	5 20	green false hellebore five-leaved creeping raspberry unifoliate-leaved foamflower	5 5 5
Moss, lichen and liverwort layer (70)	*Barbilophozia lycopodioides* *Dicranum pallidisetum*	20 10	*Barbilophozia floerkei* *Pleurozium schreberi*	20 10

CHARACTER SPECIES

Present	Absent
alpine fir black blueberry white-flowered rhododendron broad-leaved arnica Sitka valerian *Barbilophozia lycopodioides* *Dicranum pallidisetum*	

TERRAIN AND SOILS

Terrain: colluvial, morainal
Soil Texture: sand to silty clay loam
Soil Association Comp: NK 5; HP 5; SM 3; DZ 3, 5, 11; BS 3, 4, 7; BB 1, 5; HS 5; HK 6
Moisture Regime: submesic to subhygric
Drainage: well to imperfectly

TOPOGRAPHY

Elevation: 1360-1860 m (4460-6100 ft)
Slope: 0 - 26°
Aspect: level to 360°
Landscape Position: lower slope to upper slope

ECOLOGY

The soils of this type are primarily Podzols with some Luvisols also present. Parent materials are mainly acidic quartzites. The climate for this type of the forested subzone is not as severe as the climate of the krummholz subzone.

TABLE 3.12: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 11

Type 11	Alpine fir - white-flowered rhododendron - oak fern - five-leaved creeping raspberry

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -
Zone: Subalpine Engelmann spruce - alpine fir
Subzone: forested

Successional stage: Maturing Climax
Stand appearance: relatively open coniferous forests

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (30)	alpine fir Engelmann spruce (X white)	10 10	-	-
Tall shrub layer (25)	alpine fir	25	-	-
Low shrub layer (50)	white-flowered rhododendron black blueberry	20 10	Pacific menziesia oval-leaved blueberry	10 5
Herb layer (20)	oak fern five-leaved creeping raspberry	20 10	Canadian bunchberry stiff club-moss	10 5
Moss, lichen and liverwort layer (60)	Pleurozium schreberi	20	Ptilium crista-castrensis Barbilophozia lycopodioides	5 10

CHARACTER SPECIES

Present	Absent
alpine fir Engelmann spruce (X white) white-flowered rhododendron black blueberry oak fern five-leaved creeping raspberry Pleurozium schreberi	

TERRAIN AND SOILS

Terrain: fluvial, lacustrine, colluvial, morainal
Soil Texture: sand to silty clay loam
Soil Association Comp: DC 1, 2; OV 1; DZ 1; BB 1; HL 2, 3; NK 4; FG 1
Moisture Regime: submesic to subhygric
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1080-1710 m (3540-5600 ft)
Slope: 0 - 25°
Aspect: level to 360°
Landscape Position: valley floor to upper slope

ECOLOGY

The soils of this type are mainly Podzolic with some Luvisolic soils also present.

TABLE 3.13: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 12

Type 12	Engelmann spruce (X white spruce) - black blueberry - broad-leaved arnica - five-leaved creeping raspberry

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -

Zone: Subalpine Engelmann spruce - alpine fir
Subzone: forested

Successional stage: Maturing Climax
Stand appearance: relatively open coniferous forests

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (30)	Engelmann spruce (X white)	20	alpine fir	5
Tall shrub layer (15)	alpine fir	10	Engelmann spruce	5
Low shrub layer (20)	black blueberry	5	oval-leaved blueberry alpine fir	5 10
Herb layer (30)	broad-leaved arnica five-leaved creeping raspberry	1 5	Canadian bunchberry common horsetail Sitka valerian	5 1 10
Moss, lichen and liverwort layer (80)	Pleurozium schreberi	30	Barbilophozia lycopodioides Ptilium crista-castrensis	20 5

CHARACTER SPECIES

Present	Absent
Engelmann spruce (X white) alpine fir black blueberry broad-leaved arnica five-leaved creeping raspberry Pleurozium schreberi	white-flowered rhododendron

TERRAIN AND SOILS

Terrain: lacustrine, colluvial, morainal, fluvial
Soil Texture: sand to silty clay loam
Soil Association Comp: DC 7; BO 7; HK 4; HP 7; NK 7

Moisture Regime: mesic to subhygric
Drainage: well to imperfectly

TOPOGRAPHY

Elevation: 1110-1550 m (3640-5080 ft)
Slope: 0 - 28°
Aspect: level to 250°
Landscape Position: lower slope to upper slope

ECOLOGY

The soils of this type are mainly Luvisols, but include Podzols. Soils are often gleyed as a result of temporary seepage.

TABLE 3.14: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 13

Type 13	Engelmann spruce - black swamp gooseberry - five-leaved creeping raspberry - green false hellebore

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -

Zone: Subalpine Engelmann spruce - alpine fir
Subzone: forested

Successional stage: Maturing Climax
Stand appearance: open coniferous forests

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (20)	Engelmann spruce	20	alpine fir	10
Tall shrub layer ( )	-	-	-	-
Low shrub layer (30)	black swamp gooseberry alpine fir	2 10	twinberry honeysuckle oval-leaved blueberry	1 2
Herb layer (100)	five-leaved creeping raspberry green false hellebore	5 5	common horsetail Sitka valerian Canadian bunchberry	1 5 5
Moss, lichen and liverwort layer (40)	Pleurozium schreberi	20	-	-

CHARACTER SPECIES

Present	Absent
Engelmann spruce alpine fir black swamp gooseberry Pacific menziesia five-leaved creeping raspberry green false hellebore	white-flowered rhododendron

TERRAIN AND SOILS

Terrain: fluvial, morainal, colluvial
Soil Texture: sand to silt loam
Soil Association Comp: DC 7; CS 2, 4; PX 10; DZ 5

Moisture Regime: mesic to hygric
Drainage: well to imperfectly

TOPOGRAPHY

Elevation: 1060-1430 m (3480-4690 ft)
Slope: 0 - 33°
Aspect: level to 360°
Landscape Position: valley floor to middle slope

ECOLOGY

This type is wetter than the previous types in the forested subzone. Soils are generally subject to constant seepage and remain moist throughout the growing season.

TABLE 3.15: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 14

Type 14	White spruce - twinberry honeysuckle - Canadian bunchberry - northern twinflower

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: -
Zone: Subalpine Engelmann spruce - alpine fir
Subzone: forested

Successional stage: Maturing Climax
Stand appearance: closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (50)	white spruce	35	alpine fir Engelmann spruce black cottonwood	5 5 5
Tall shrub layer (15)	Engelmann spruce	10	white spruce alpine fir	1 1
Low shrub layer (20)	twinberry honesuckle	10	soopolallie black swamp gooseberry	1 1
Herb layer (40)	Canadian bunchberry northern twinflower fireweed	5 15 1	common horsetail many-flowered one-sided wintergreen palmate colt's-foot	10 1 1
Moss, lichen and liverwort layer (80)	Hylocomium spledens	30	Pleurozium schreberi Ptilium crista-castrensis	20 5

CHARACTER SPECIES

Present	Absent
white spruce alpine fir twinberry honeysuckle Canadian bunchberry northern twinflower fireweed palmate colt's-foot many-flowered one-sided wintergreen Hylocomium spledens	white-flowered rhododendron

TERRAIN AND SOILS

Terrain: mostly fluvial terrace
Soil Texture: sand to loamy
Soil Association Comp: KN 1, 2; OV 1; RN 7; HS 2; HO 1

Moisture Regime: mesic to subhygric
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 1130-1400 m (3700-4590 ft)
Slope: 0 - 8°
Aspect: level to 340°
Landscape Position: valley floor to middle slope

ECOLOGY

This type is found predominantly on Regosols, but also occurs on Brunisols and Podzols.

TABLE 3.16: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 15

Type 15	Bog willow - bog glandular birch - water sedge - *Sphagnum* spp.

VEGETATION CHARACTERISTICS

Region:	Boreal, Subboreal, Interior Wet Belt	Zone:	Subalpine Engelmann spruce - alpine fir
Section:	-	Subzone:	forested

Successional stage: Maturing Edaphic Climax
Stand appearance: bog

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (20)	bog willow bog glandular birch	5 20	-	-
Herb layer (80)	water sedge	10	beaked sedge bristle-stalked sedge narrow-leaved cotton-grass	60 2 20
Moss, lichen and liverwort layer (80)	*Sohagnum* spp.	45	*Tomenthyphum nitens*	40

CHARACTER SPECIES

Present	Absent
bog willow bog glandular birch water sedge *Sphagnum* spp.	

TERRAIN AND SOILS

Terrain: organic blankets and veneers
Soil Texture: mostly fibric
Soil Association Comp: OV 8; HA 1, 4; DC 8; MT 1 (1976)

Moisture Regime: hygric to subhygric
Drainage: poor to very poor

TOPOGRAPHY

Elevation: 930-1220 m (3050-4000 ft)
Slope: mostly 0°
Aspect: mostly level
Landscape Position: valley floor to lower slope

ECOLOGY

The soils of this type are organic, mainly Fibrisols, but also include peaty phase gleysols.

TABLE 3.17: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 16

Type 16	White spruce X Engelmann spruce - alpine fir - black swamp gooseberry - oak fern

VEGETATION CHARACTERISTICS

Region: Boreal, Subboreal, Interior Wet Belt
Section: Parsnip

Zone: Subboreal white spruce - alpine fir
Subzone: common paper birch

Successional stage: Maturing Climatic Climax
Stand appearance: open coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (25)	white spruce X Engelmann spruce alpine fir	20 10	-	-
Tall shrub layer (15)	alpine fir	10	white spruce X Engelmann spruce	5
Low shrub layer (30)	black swamp gooseberry devil's-club	5 10	oval-leaved blueberry twinberry honeysuckle alpine fir	2 5 5
Herb layer (90)	oak fern Canadian bunchberry five-leaved creeping raspberry	30 15 5	simple-stemmed twistedstalk common horsetail spiny shield fern	15 10 20
Moss, lichen and liverwort layer (20)	Pleurozium schreberi	10	Ptilium crista-castrensis Rhytidiadelphus squarrosus	5 5

CHARACTER SPECIES

Present	Absent
white spruce X Engelmann spruce alpine fir black swamp gooseberry devil's-club oak fern Canadian bunchberry five-leaved creeping raspberry Pleurozium schreberi	

TERRAIN AND SOILS

Terrain: lacustrine and fluvial
Soil Texture: sand to clay
Soil Association Comp: BO 1; DC 2; HL 1; FG 1

Moisture Regime: mesic to subhygric
Drainage: mostly moderately well

TOPOGRAPHY

Elevation: 910-1200 m (2980-3940 ft)
Slope: 0 - 6°
Aspect: level to 330°
Landscape Position: valley floor to lower slope

ECOLOGY

This type is restricted to lower elevations. The soils are mainly Luvisols and Podzols. Cold air drainage may explain the presence of some typically subalpine species (i.e. Sitka valerian and green false hellebore) and proximity to zone boundaries results in the inclusion of some soil association components characteristic of the subalpine.

TABLE 3.18: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 17

Type 17	Single releve Bog willow - Sitka sedge - *Brachythecium* sp.

VEGETATION CHARACTERISTICS

Region: Subboreal
Section: Parsnip

Zone: Subboreal white spruce - alpine fir
Subzone: common paper birch

Successional stage: Maturing Edaphic Climax
Stand appearance: bog

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (1)	bog willow	1	Scouler's willow	1
Herb layer (95)	Sitka sedge	80	beaked sedge water sedge	10 5
Moss, lichen and liverwort layer (5)	*Brachythecium* sp. *Mnium rugicum*	3 2	-	-

CHARACTER SPECIES

Present	Absent
bog willow Sitka sedge *Brachythecium* sp. *Mnium rugicum*	

TERRAIN AND SOILS

Terrain: lacustrine blanket
Soil Texture: -
Soil Association Comp: KN 8

Moisture Regime: hygric
Drainage: imperfectly

TOPOGRAPHY

Elevation: 930 m (3050 ft)
Slope: 0°
Aspect: level
Landscape Position: valley floor

ECOLOGY

The soil of this type is fibric gleysol. Soils have a water table usually within 50 cm of the surface or are subject to permanent lateral seepage.

TABLE 3.19: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 18

Type 18	Lodgepole pine - velvet-leaved blueberry - Canadian bunchberry

VEGETATION CHARACTERISTICS

Region: Boreal
Section: Wapiti
Zone: Boreal white spruce
Subzone: black spurce

Successional stage: Young Seral
Stand appearance: relatively closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (40)	lodgepole pine	40	-	-
Tall shrub layer (20)	black spruce	20	-	-
Low shrub layer (30)	velvet-leaved blueberry common Labrador tea	15 5	prickly rose	1
Herb layer (30)	Canadian bunchberry	5	mountain cranberry northern twinflower	1 2
Moss, lichen and liverwort layer (50)	Pleurozium schreberi	30	Cladina spp. Peltigera aphthosa	20 20

CHARACTER SPECIES

Present	Absent
lodgepole pine velvet-leaved blueberry common Labrador tea Canadian bunchberry Pleurozium schreberi	

TERRAIN AND SOILS

Terrain: fluvial terrace
Soil Texture: sand
Soil Association Comp: OV 1; HO 1

Moisture Regime: subxeric to submesic
Drainage: rapidly to well

TOPOGRAPHY

Elevation: 1110-1200 m (3640-3940 ft)
Slope: 6 to 7°
Aspect: 165 to 310°
Landscape Position: lower slope to middle slope

ECOLOGY

The soils of this type are Podzols or Brunisols located on fluvial terrace materials. This type is very limited in extent and is present in the extreme northeast corner of the Study Area. It is located on the east side of the Rockies and is therefore drier in summer and colder in winter than the types at similar elevations in the Study Area.

TABLE 3.20: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 19

Type 19	White spruce - alpine fir - devil's-club - oak fern - unifoliate-leaved foamflower

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride

Zone: Interior western red cedar - white spruce
Subzone: -

Successional stage: Maturing Climatic Climax
Stand appearance: closed mixed forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (65)	white spruce alpine fir	30 25	western red cedar common paper birch	45 20
Tall shrub layer (15)	white spruce	10	alpine fir western red cedar	10 15
Low shrub layer (45)	devil's-club western thimbleberry	30 5	black swamp gooseberry western red cedar	1 10
Herb layer (65)	oak fern unifoliate-leaved foamflower Canadian bunchberry	15 10 5	simple-stemmed twistedstalk wild sarsaparilla common lady fern	5 8 20
Moss, lichen and liverwort layer (45)	*Pleurozium schreberi* *Ptilium crista-castrensis*	10 5	*Mnium drummondii* *Hylocomium splendens*	5 20

CHARACTER SPECIES

Present	Absent
white spruce alpine fir devil's-club western thimbleberry oak fern unifoliate-leaved foamflower Canadian bunchberry *Pleurozium schreberi*	

TERRAIN AND SOILS

Terrain: fluvial (mostly fluvial terrace)
Soil Texture: mostly sand
Soil Association Comp: LO 1, 2, 7; PM 1; FN 1 (mostly LO 1)

Moisture Regime: mesic
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 650-780 m (2130-2560 ft)
Slope: 0 - 32° (mostly 0°)
Aspect: level to 278°
Landscape Position: valley floor to lower slope

ECOLOGY

The soils of this type are primarily Podzols with minor inclusions of Luvisols. This type is approaching climax and occurs commonly on sites enriched by moisture and nutrients carried in temporary subsurface seepage water. No western hemlock is present probably due to the frequent occurrence of advective and radiation frosts at lower elevations of the Interior western red cedar - white spruce zone.

TABLE 3.21: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 20

Type 20	White spruce - common paper birch - twinberry honeysuckle - red-osier dogwood - dwarf red blackberry

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride

Zone: Interior western red cedar - white spruce
Subzone: -

Successional stage: Overmature Seral
Stand appearance: closed mixed forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (60)	white spruce common paper birch	40 15	black cottonwood alpine fir	50 2
Tall shrub layer (5)	white spruce	5	-	-
Low shrub layer (75)	twinberry honeysuckle red-osier dogwood	5 5	high bush cranberry prickly rose western thimbleberry	5 2 10
Herb layer (60)	dwarf red blackberry oak fern	1 15	Canadian bunchberry simple-stemmed twistedstalk wild sarsaparilla	10 1 15
Moss, lichen and liverwort layer (30)	*Rhytidiadelphus triquetrus*	10	*Pleurozium schreberi* *Ptilium crista-castrensis*	10 5

CHARACTER SPECIES

Present		Absent
white spruce common paper birch twinberry honeysuckle red-osier dogwood dwarf red blackberry	oak fern *Rhytidiadelphus triquetrus*	

TERRAIN AND SOILS

Terrain: mostly fluvial
Soil Texture: sandy loam to clay
Soil Association Comp: LO 1; GF 1, 7; RH 4, 7; LZ 1

Moisture Regime: mesic to subhygric
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 630-790 m (2070-2590 ft)
Slope: 0 - 30°
Aspect: level to 342°
Landscape Position: valley floor to lower slope

ECOLOGY

The absence of western hemlock is probably due to advective and radiation frosts which occur along the lower slopes and valley floors of the Interior western red cedar - white spruce zone. The climate of this type is expected to be warmer and wetter than for vegetation types on the eastern side of the Rocky Mountains.

TABLE 3.22: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 21

Type 21	White spruce - lodgepole pine - soopolallie - rough-leaved rice grass - northern twinflower

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride

Zone: Interior western red cedar - white spruce
Subzone: -

Successional stage: Mature Seral
Stand appearance: open to closed mixed forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (35)	white spruce lodgepole pine	25 15	Rocky Mountain Douglas-fir common paper birch trembling aspen	2 15 5
Tall shrub layer (10)	white spruce	5	alpine fir	4
Low shrub layer (40)	soopolallie prickly rose	20 5	western thimbleberry twinberry honeysuckle common saskatoon	15 4 1
Herb layer (80)	rough-leaved rice grass northern twinflower Canadian mayflower	5 20 1	birch-leaved spirea Canadian bunchberry common western pipsissewa	10 30 1
Moss, lichen and liverwort layer (60)	*Pleurozium schreberi*	30	*Rhytidiadelphus triquetrus* *Dicranum scoparium*	20 5

CHARACTER SPECIES

Present		Absent
white spruce lodgepole pine soopolallie prickly rose rough-leaved rice grass	northern twinflower Canadian mayflower *Pleurozium schreberi*	

TERRAIN AND SOILS

Terrain: mostly fluvial terrace
Soil Texture: sand
Soil Association Comp: LO 1, 2, 4; PM 2

Moisture Regime: submesic to mesic
Drainage: well

TOPOGRAPHY

Elevation: 650-770 m (2130-2530 ft)
Slope: 0 - 35°
Aspect: level to 226°
Landscape Position: valley floor to lower slope

ECOLOGY

The soils of this type include Brunisols and Podzols and occur on freely drained upper terraces.

TABLE 3.23: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 22

Type 22	Lodgepole pine - common Labrador tea - bog cranberry

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride
Zone: Interior western red cedar - white spruce
Subzone: -

Successional stage: Maturing Edaphic Climax
Stand appearance: treed bog

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (20)	lodgepole pine	20	-	-
Tall shrub layer (5)	-	-	lodgepole pine white spruce	8 2
Low shrub layer (20)	common Labrador tea alpine fir	20 1	bog glandular birch	1
Herb layer (40)	bog cranberry	2	buckbean bog rosemary round-leaved sundew	1 1 1
Moss, lichen and liverwort layer (80)	*Sphagnum capillaceum*	60	*Pleurozium schreberi* *Sphagnum papillosum*	1 20

CHARACTER SPECIES

Present	Absent
lodgepole pine common Labrador tea alpine fir bog cranberry *Sphagnum capillaceum*	

TERRAIN AND SOILS

Terrain: organic blanket; fluvial
Soil Texture: clay to mesic (organic)
Soil Association Comp: LO 8; CC 4

Moisture Regime: subhygric
Drainage: poorly to very poorly

TOPOGRAPHY

Elevation: 640-810 m (2100-2660 ft)
Slope: 0°
Aspect: level
Landscape Position: lower slope

ECOLOGY

Soils are peaty phase gleysols and organics. The water table is at or near the surface for most of the year.

TABLE 3.24: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 23

Type 23	Hoary sedge - hemlock water-parsnip

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride

Zone: Interior western red cedar - white spruce
Subzone: -

Successional stage: Maturing Edaphic Climax
Stand appearance: bog

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (0)	-	-	-	-
Tall shrub layer (0)	-	-	-	-
Low shrub layer (1)	willow spp.	1	-	-
Herb layer (70)	hoary sedge hemlock water-parsnip	1 1	-	-
Moss, lichen and liverwort layer (0)	-	-	-	-

CHARACTER SPECIES

Present	Absent
hoary sedge hemlock water-parsnip	

TERRAIN AND SOILS

Terrain: organic veneers over fluvial materials
Soil Texture: sand with humic organic veneers
Soil Association Comp: LO 8

Moisture Regime: subhydric
Drainage: very poorly

TOPOGRAPHY

Elevation: 610 m (2000 ft)
Slope: 0°
Aspect: level
Landscape Position: valley floor to level areas at lower slope positions

ECOLOGY

The soils of this type are Humisols.

TABLE 3.25: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 24

Type 24	**Western hemlock - western red cedar - black blueberry - oak fern - Canadian bunchberry**

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride
Zone: Interior western hemlock - western red cedar
Subzone: -

Successional stage: Maturing Climax
Stand appearance: closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (60)	white spruce alpine fir	25 10	western hemlock western red cedar	40 40
Tall shrub layer (25)	western hemlock	5	western red cedar	5
Low shrub layer (40)	devil's-club black blueberry black swamp gooseberry	15 2 1	western hemlock western red cedar oval-leaved blueberry	5 5 5
Herb layer (80)	oak fern Canadian bunchberry	40 10	five-leaved creeping raspberry simple-stemmed twistedstalk unifoliate-leaved foamflower blue-bead clintonia	10 1 5 5
Moss, lichen and liverwort layer (90)	*Ptilium crista-castrensis* *Pleurozium schreberi*	10 10	*Hylocomium splendens* *Rhytidiadelphus triquetrus*	30 20

CHARACTER SPECIES

Present		Absent
white spruce	black blueberry	
alpine fir	oak fern	
western hemlock	Canadian bunchberry	
western red cedar	*Ptilium crista castrensis*	
devil's-club	*Pleurozium schreberi*	

TERRAIN AND SOILS

Terrain: fluvial, lacustrine, morainal and colluvial
Soil Texture: sandy loam to silty clay
Soil Association Comp: LZ 1, 7; RH 1, 3, 4, 7; PM 1, 8; FG 1; LO 4; WD 1, 2, 5; FN 1
Moisture Regime: mesic to subhygric
Drainage: well to imperfectly

TOPOGRAPHY

Elevation: 710-1190 m (2330-3900 ft)
Slope: 0 - 47°
Aspect: level to 346°
Landscape Position: lower slope

ECOLOGY

The soils of this type include Podzols, Luvisols and Brunisols. This type is subject to greater annual precipitation and milder winter temperatures than those types located east of the Rocky Mountains.

TABLE 3.26: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 25

Type 25	Western hemlock - western red cedar - oval-leaved blueberry - Canadian bunchberry - five-leaved creeping.raspberry

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride

Zone: Interior western hemlock - western red cedar
Subzone: -

Successional stage: Maturing Climax
Stand appearance: moderately open to closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (70)	alpine fir white spruce	30 20	western hemlock western red cedar	40 15
Tall shrub layer (10)	western hemlock	10	western red cedar	5
Low shrub layer (15)	alpine fir western hemlock oval-leaved blueberry	10 5 1	western hemlock western red cedar oval-leaved blueberry	1 5
Herb layer (50)	Canadian bunchberry five-leaved creeping raspberry	20 10	five-leaved creeping raspberry simple-stemmed twistedstalk unifoliate-leaved foamflower	10 5 1
Moss, lichen and liverwort layer (80)	*Hylocomium splendens* *Pleurozium schreberi*	40 10	*Ptilium crista-castrensis* *Rhytidiadelphus triquetrus*	10 20

CHARACTER SPECIES

Present		Absent
alpine fir white spruce western hemlock western red cedar oval-leaved blueberry	Canadian bunchberry five-leaved creeping raspberry *Hylocomium splendens* *Pleurozium schreberi*	devil's-club

TERRAIN AND SOILS

Terrain: mostly lacustrine and fluvial
Soil Texture: sand to clay
Soil Association Comp: RH 1, 3, 7, 8; PM 1; LZ 7;
LO 1, 2, 4; OV 1
Moisture Regime: mostly mesic
Drainage: well to moderately well

TOPOGRAPHY

Elevation: 400-920 m (2430-3020 ft)
Slope: 0 - 28°
Aspect: level to 336°
Landscape Position: mostly lower slope

ECOLOGY

The soils of this type are Luvisols and Podzols, with minor Gleysolic inclusions. Surface horizons are generally strongly acidic. Mild winter temperatures and large amounts of precipitation characterize the climate of this type.

TABLE 3.27: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 26

Type 26	Rocky Mountain Douglas-fir - western red cedar - western hemlock - common western pipsissewa - many-flowered one-sided wintergreen

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride
Zone: Interior western hemlock - western red cedar
Subzone: -

Successional stage: Overmature Seral
Stand appearance: closed coniferous forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (80)	Rocky Mountain Douglas-fir	30	white spruce western hemlock western red cedar	5 20 15
Tall shrub layer (15)	western red cedar western hemlock	5 10	-	-
Low shrub layer (5)	western red cedar western hemlock	5 1	black blueberry	1
Herb layer (10)	common western pipsissewa many-flowered one-sided wintergreen	1 1	false Solomon's-seal green pyrola	1 1
Moss, lichen and liverwort layer (80)	*Hylocomium splendens*	80	*Pleurozium schreberi* *Rhytidiadelphus triquetrus* *Ptilium crista-castrensis*	5 10 5

CHARACTER SPECIES

Present	Absent
Rocky Mountain Douglas-fir western red cedar western hemlock common western pipsissewa many-flowered one-sided wintergreen	

TERRAIN AND SOILS

Terrain: morainal, glaciofluvial, colluvial, fluvial
Soil Texture: sand
Soil Association Comp: PM 1; WD 1, 2, 5; LZ 1, 5; LO 2

Moisture Regime: submesic to mesic
Drainage: rapidly to moderately well

TOPOGRAPHY

Elevation: 730-940 m (2400-3080 ft)
Slope: 0 - 38°
Aspect: level to 300°
Landscape Position: lower slope to middle slope

ECOLOGY

The soils of this type are dominantly Podzols with Brunisolic inclusions.

TABLE 3.28: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 27

Type 27	Common paper birch - Sitka willow - birch-leaved spirea - Douglas' aster

VEGETATION CHARACTERISTICS

Region: Interior Wet Belt
Section: McBride
Zone: Interior western hemlock - western red cedar
Subzone: -

Successional stage: Young Seral
Stand appearance: relatively closed mixed forest

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (50)	common paper birch trembling aspen	40 20	-	-
Tall shrub layer (15)	Sitka willow	5	white spruce Rocky Mountain maple	1 5
Low shrub layer (65)	Sitka willow western thimbleberry	5 30	red-osier dogwood prickly rose	2 2
Herb layer (40)	birch-leaved spirea Douglas' aster mountain sweetcicely	15 10 1	Canadian bunchberry northern twinflower many-flowered one-sided wintergreen	10 15 1
Moss, lichen and liverwort layer (20)	Rhytidiadelphus triquetrus Pleurozium schreberi	5 10	-	-

CHARACTER SPECIES

Present		Absent
common paper birch trembling aspen Sitka willow western thimbleberry birch-leaved spirea	Douglas' aster mountain sweetcicely Rhytidiadelphus triquetrus Pleurozium schreberi	

TERRAIN AND SOILS

Terrain: mainly colluvial (some morainal, fluvial)
Soil Texture: loamy sand to clay
Soil Association Comp: WD 2; PM 4, 8; LZ 2; HL 2; RK 5

Moisture Regime: mesic
Drainage: well

TOPOGRAPHY

Elevation: 730-1290 m (2400-4230 ft)
Slope: 3 - 41°
Aspect: 44 to 320°
Landscape Position: lower slope

ECOLOGY

Soils are variable, including Luvisols, Brunisols, Podzols and Regosols. This type appears to favour a south to southwest aspect and can therefore expect a drier and warmer microclimate as a result.

TABLE 3.29: VEGETATION CHARACTERISTICS OF VEGETATION TYPE 28

Type 28	Lodgepole pine - black spruce - bog glandular birch - bog cranberry - narrow-leaved cotton-grass

VEGETATION CHARACTERISTICS

Region:	Interior Wet Belt	Zone:	Interior western hemlock - western red cedar
Section:	McBride	Subzone:	-

Successional stage: Maturing Edaphic Climax
Stand appearance: treed bog

SPECIES COMPOSITION

Layer (% crown cover)	Dominants	%crown cover	Associates	%crown cover
Tree layer (1)	black spruce	1	-	-
Tall shrub layer (10)	lodgepole pine	10	-	-
Low shrub layer (20)	bog glandular birch	5	common Labrador tea willow spp.	5 2
Herb layer (70)	bog cranberry narrow-leaved cotton-grass bog rosemary	5 5 5	Sitka sedge	20
Moss, lichen and liverwort layer (100)	*Sphagnum capillaceum*	70	-	-

CHARACTER SPECIES

Present	Absent
bog glandular birch bog cranberry narrow-leaved cotton-grass bog rosemary *Sphagnum capillaceum*	

TERRAIN AND SOILS

Terrain: organic blanket
Soil Texture: fibric and mesic organic soils
Soil Association Comp: CC 1, 4, 5, 6 (mostly CC 4)

Moisture Regime: subhydric
Drainage: poorly to very poorly

TOPOGRAPHY

Elevation: 730-920 m (2400-3020 ft)
Slope: 0°
Aspect: level
Landscape Position: lower slope

ECOLOGY

The soils of this type are Mesisols and Fibrisols.

CHAPTER FOUR
VEGETATION TYPE - SUCCESSIONAL RELATIONSHIPS

4.1 VEGETATION SUCCESSION

Vegetation succession is defined as "the progressive development of vegetation to a stable endpoint (climax) following a disturbance which has destroyed all or part of the existing vegetation without significantly altering the local climate and soils of the site (changes in microclimate may occur)" (Lea, 1984).

With a knowledge of the natural succession of a landscape, the land manager is able to predict what, in terms of vegetation succession, will happen when he applies a certain management practice to the landscape. For example, a land manager planning enhancement of an area for wildlife or for livestock would know whether an area requires burning to achieve the desired vegetation or whether the desireable vegetation will occur naturally through time. A knowledge of natural succession of an area, as well as the rate of succession, will allow the land manager to predict the cost and effort required to achieve desired objectives.

4.2 SUCCESSIONAL TRENDS

Table 4.1 shows the successional trends of the subzones in the zones of each region of the Study Area. The successional trends discussed in this table are very general and, although a full range of intermediate successional stages may be encountered, only four stages of succession are discussed. These include: young seral, maturing seral, overmature seral and maturing climax. Pioneer seral vegetation is not discussed since no sampling was conducted in recently disturbed areas. This table will help predict the successional development of a specific vegetation type once the present successional status of the type is known.

TABLE 4.1: SUCCESSIONAL TRENDS OF THE VEGETATION OF THE STUDY AREA[1]

SUCCESSIONAL STATUS							
REGION	ZONE	SUBZONE	YOUNG SERAL	MATURE SERAL	OVERMATURE SERAL	MATURING CLIMAX	COMMENTS
Subboreal and Interior Wet Belt	Alpine tundra	-	The tundra-like vegetation of this zone is dominated by dwarf shrubs and low-lying herbs. The Alpine tundra zone is made up of a mosaic of numerous micro-communities which are constantly changing. The extreme tundra climate together with geomorphological processes such as cryoturbation, solifluction and nivation strongly effect the composition and duration of specific communities. 1 2 3 4				Extremely slow rate of succession; moisture regimes variable; soils generally shallow and rocky; extremely sensitive to disturbance; colluvial and morainal materials dominate.
Boreal and Subboreal and Interior Wet Belt	Subalpine Engelmann spruce - alpine fir	a) forested	Stands are composed of lodgepole pine in the tree canopy with an understory of white-flowered rhododendron and black blueberry.	Relatively closed even-aged stands of lodgepole pine with Engelmann spruce and alpine fir beginning to establish in the understory. 9	Canopy opening up as lodgepole pine begins to die off. Alpine fir and Engelmann spruce are dominant species of the tree canopy. White-flowered rhododendron and black blueberry are present in the understory.	Closed stands with Engelmann spruce and alpine fir present in all age and height classes. Understory commonly includes white-flowered rhododendron, black blueberry, Sitka valerian and broad-leaved arnica. 10 11 12 13 14 Edaphic Climax Subalpine meadows present on wetter sites. Bogs and fens also present. 15	Slow rate of succession; moisture regimes variable; climatic conditions more moderate than Alpine tundra zone or krummholz subzone; disturbance by fire is more common than in krummholz subzone; colluvial, morainal, fluvial and lacustrine materials dominate.

[1] Numbers in the table represent vegetation types sampled; for a description see Chapter 3.

TABLE 4.1: (CONTINUED)

			SUCCESSIONAL STATUS				
REGION	ZONE	SUBZONE	YOUNG SERAL	MATURE SERAL	OVERMATURE SERAL	MATURING CLIMAX	COMMENTS
Boreal and Subboreal and Interior Wet Belt	Subalpine Engelmann spruce - alpine fir	b) krummholz	Clumps of stunted even-aged lodgepole pine trees and open tundra vegetation including red mountain-heather and Mertens' cassiope.	Clumps of stunted even-aged lodgepole pine trees having a relatively closed overstory and Engelmann spruce and/or alpine fir regenerating underneath. Tundra vegetation surrounding the clumps of stunted trees.	Clumps of stunted trees composed of a mixture of lodgepole pine, alpine fir and Engelmann spruce are the dominant species of the tree canopy with lodgepole pine present as a minor component. Tundra vegetation also present. 7	Clumps of stunted alpine fir and Engelmann spruce surrounded by open tundra vegetation. 8 Edaphic Climax Subalpine meadows present on wetter sites and comprised of such herbs as Sitka valerian, showy sedge and green false hellebore. 5 6	Very slow rate of succession; very sensitive to disturbance, may take hundreds of years to revegetate after disturbance; nutrient cycling of communities in this subzone is extremely slow probably due to severe climatic conditions; colluvial, fluvial and morainal materials dominate; moisture regimes variable.
Subboreal	Subboreal white spruce - alpine fir	Rocky Mountain Douglas-fir	Young and even-aged stands of Rocky Mountain Douglas-fir present on medium-textured soils. Lodgepole pine, trembling aspen or common paper birch may also dominate young seral tree canopy. Specific tree species present appear to be dependent on soils.	Relatively closed even-aged stands of seral tree species with alpine fir and white spruce (or white spruce X Engelmann spruce hybrid) beginning to establish in the understory.	Alpine fir and white spruce (or white spruce X Engelmann spruce hybrid) dominate the tree canopy. Seral tree species are still present but are slowly dying off. Understory shrubs and herbs are typical of climax stands.	Relatively closed stands with alpine fir and white spruce (or Engelmann X white spruce) present in all age and height classes. Understory vegetation determined by soils, drainage, moisture regime, etc. Edaphic Climax Bogs and Fens	Normal rate of succession; moisture regimes variable; Subboreal white spruce - alpine fir zone has remained free of disturbance for a long time (Harcombe, 1978); Rocky Mountain Douglas-fir subzone restricted to lower sections of the Fraser and McGregor River Valleys.

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[1] Numbers in the table represent vegetation types sampled; for a description see Chapter 3.

TABLE 4.1: (CONTINUED)

			SUCCESSIONAL STATUS				
REGION	ZONE	SUBZONE	YOUNG SERAL	MATURE SERAL	OVERMATURE SERAL	MATURING CLIMAX	COMMENTS
Subboreal	Subboreal white spruce - alpine fir	common paper birch	Rocky Mountain Douglas-fir is not present as a seral tree species on medium-textured soils but may occur on shallow soils and on south aspects. Young and even-aged stands are made up of lodgepole pine, trembling aspen or common paper birch.	Relatively closed even-aged stands of seral tree species with alpine fir and white spruce (or Engelmann X white spruce) beginning to establish in the understory.	Tree canopy opening up as seral species die off. Alpine fir and white spruce (or Engelmann X white spruce) are beginning to dominate the tree canopy. Shrubs and herbs of the understory are similar to those of climax stands.	Relatively closed stands with alpine fir and white spruce (or Engelmann X white spruce) present in all age and height classes. Understory vegetation commonly composed of western thimbleberry, blueberries and Canadian bunchberry. Edaphic Climax Bogs and Fens 17	Normal rate of succession; specific seral tree species present on a certain site appears to be dependent on soil conditions; moisture regimes variable; lacustrine and fluvial materials dominate; this subzone is cooler and wetter than the Rocky Mountain Douglas-fir subzone.
Boreal	Boreal white spruce	black spruce	Young and even-aged stands of lodgepole pine or trembling aspen (on finer-textured surficial materials). Black spruce is present under lodgepole pine stands on coarse-textured materials. 18	Relatively closed even-aged stands of seral tree species with white spruce regenerating underneath.	White spruce dominates the tree canopy but seral tree species are present. As these seral species die off, the tree canopy opens up allowing climax species to occupy the dominant tree layer.	Relatively closed stands of white spruce present in all age and height classes. Some remnants of seral stands may remain but have a very small cover. Edaphic Climax Black spruce stands and bogs and fens.	Slow rate of succession probably due to cold and dry climate and parent materials often low in nutrients (Harcombe, 1978). This zone is subject to numerous disturbances, primarily fires; moisture regimes variable; morainal, fluvial and colluvial materials dominate.

[1] Numbers in the table represent vegetation types sampled; for a description see Chapter 3.

TABLE 4.1: (CONTINUED)

			SUCCESSIONAL STATUS				
REGION	ZONE	SUBZONE	YOUNG SERAL	MATURE SERAL	OVERMATURE SERAL	MATURING CLIMAX	COMMENTS
Interior Wet Belt	Interior western red cedar - white spruce	-	Young and even-aged stands of common paper birch, lodgepole pine or trembling aspen.	Relatively closed even-aged stands of seral tree species with white spruce, alpine fir and western red cedar beginning to establish in the understory. 21	Tree canopy opening up as seral species die off. White spruce, alpine fir and western red cedar beginning to dominate the main tree canopy. Shrubs and herbs of the understory are similar to those of climax stands. 20	Relatively closed stands with white spruce and alpine fir as the dominant tree species and western red cedar present as a major constituent. All tree species are present in all age and height classes. 19 Edaphic Climax Bogs 22 23	Normal rate of succession; moisture regimes variable; the presence of a specific seral tree species (i.e. lodgepole pine, trembling aspen, or common paper birch) on a certain site appears to be dependent on moisture and nutrient regimes; fluvial and glaciofluvial materials dominate.
	Interior western hemlock - western red cedar zone	-	Young and even-aged stands of lodgepole pine or trembling aspen. Rocky Mountain Douglas-fir is an important seral tree species within this zone in areas to the southeast of the Study Area. Rocky Mountain Douglas-fir occurs sporadically on south-facing slopes in the Study Area. 27	Relatively closed even-aged stands of seral tree species with white spruce, alpine fir, western hemlock and western red cedar beginning to establish in the understory.	White spruce, alpine fir, western hemlock and western red cedar dominate the main tree canopy. Seral tree species are still present but are slowly dying off resulting in an opening up of the tree canopy. 26	Relatively closed stands with white spruce, alpine fir, western hemlock and western red cedar present in all age and height classes. 24 25 Edaphic Climax Black spruce bogs. 28	Normal rate of succession; the presence of a particular seral tree species (ie. lodgepole pine, trembling aspen or Rocky Mountain Douglas-fir) on a specific site appears to be dependent on aspect, moisture and nutrient regimes and parent materials; mixture of parent materials present including morainal, lacustrine, glaciofluvial, fluvial, colluvial and organic.

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[1] Numbers in the table represent vegetation types sampled; for a description see Chapter 3.

CHAPTER FIVE
VEGETATION INTERPRETATIONS

5.1 VEGETATION INTERPRETATIONS

Vegetation information provides a useful framework upon which a number of interpretations related to land management can be developed. The natural vegetation of an area is a resource providing recreational value (visual resource), food and cover for wildlife, and plant species useful to specific purposes. Evaluation of information on the vegetation patterns and habitat relationships of plant species are useful in predicting the responses to and possible uses of vegetation in land management. In addition, vegetation serves as an indicator of environmental (site) conditions and may be used to predict the productive potential of ecosystems, their susceptibility to damage by various management practices, and their suitability to various uses.

In the following sections, selected interpretations are provided to aid in making land management decisions. These interpretations are based on the vegetation survey data of the Southeast Extension which was collected during the 1977 field season together with information obtained from other sources. Due to the limited amount of field data, the interpretations are relatively general and are provided to serve as an aid to resource managers. More detail may be found in the 1977-1978 Preliminary Environmental Report and in various reports and memos listed in Appendix D.

5.2 VEGETATION INTERPRETATIONS FOR AGRICULTURE

The interpretations of this section are intended to be used for the management of domestic livestock.

5.2.1 GRAZING QUALITY AND POTENTIAL

The grazing quality and potential of the Southeast Extension Study Area generally is very low. Most of the vegetation types surveyed are either densely timbered, inaccessible due to high elevation and rocky terrain, or too wet. Areas in the study area having some potential for grazing are along the Fraser River, the Torpy River and the McGregor River (ELUCS, 1979) and in the Boreal Zone east of the Rocky Mountains where the terrain is rolling and forests tend to be more open (ie. Type 18). The major limitations to agriculture in the Study Area are climate, fine-textured subsoils, generally in areas below 790 metres (2600 ft) elevation, shallow soils over bedrock, stoniness and topography, generally in areas above 790 metres (2600 ft) elevation, (ELUCS, 1979).

5.2.2 RANGE CONDITION

The range condition, like the grazing quality and potential of the Study Area, is very low. Many of the types surveyed are densely timbered and therefore can be expected to have very little forage.

Walmsley et al (1980) state that rangelands include alpine tundra and wet meadows. On the basis of this statement, therefore, types 1-4 (alpine tundra) and types 5 and 6 (subalpine meadows) could be considered suitable for rangeland. However, as these types are inaccessible to domestic livestock, they are of little value as rangeland in the Study Area and are given a rating of fair to poor.

5.3 VEGETATION INTERPRETATIONS FOR CONSERVATION

5.3.1 SENSITIVE VEGETATION TYPES

All ecosystems are sensitive to disturbance to some degree. In this section, an attempt has been made to evaluate the degree to which each of the types surveyed in the Southeast Extension Study Area is sensitive to disturbance. The four sensitivity ratings which were used, including very high, high, moderate and low, were subjectively determined for each vegetation type on the basis of the susceptibility of each type to disturbance and its expected rate of recovery following disturbance. These are listed in Table 5.1.

5.3.2 RIVERBANK PROTECTION

Vegetation is very important in regulating stream flow and maintaining water quality (Boyd, 1974). When the forest cover is removed from the margins of small streams, the temperature of the water may increase to temperatures which are lethal to fish. Warmer water may also increase the activity of pathogenic organisms. Stream-side vegetation also provides an environment for terrestrial insects which are important to the diet of fish (Boyd, 1974). Leaf fall from such deciduous species as alder contributes important nutrients to the food chain.

Removal of streamside vegetation may lead to increased sedimentation of the stream due to the erosion of the riverbank and to an increase in surface runoff. Increased sedimentation is particularly harmful to fish populations which spawn in the stream.

Certain plant species are particularly useful for the protection of riverbanks and these are listed by the vegetation type in which they occur in Table 5.1

5.4 VEGETATION INTERPRETATIONS FOR FORESTRY

Table 5.2 provides forestry interpretations for each vegetation type. These interpretations are provided as general guidelines to aid land managers in developing management plans appropriate to the forest ecosystems present in the area. On-site investigation is necessary to develop management plans appropriate to individual site conditions.

5.4.1 WINDTHROW HAZARD

Windthrow hazard ratings were determined by assessing edaphic factors related to each of the vegetation types. Tree rooting habits, though determined in part by genetics and stand conditions, are strongly influenced by soil texture, soil horizons and available moisture. Windthrow hazard is generally high on sites where rooting depth is restricted by high water tables (e.g. type 13), shallow soils, or soil horizons which restrict rooting. Fine-textured (silt or clay) soils generally experience higher windthrow hazards than do coarser textured soils. However, soil texture is highly variable within each of the vegetation types and specific determination of windthrow hazard will depend on examination of soil conditions present on a site.

TABLE 5.1: VEGETATION INTERRRETATIONS FOR CONSERVATION

INTERPRETATION	VEGETATION TYPE NUMBER					
	1	2	3	4	5	6
Sensitivity of Vegetation Types[1]	very high	very high	very high	very high	high	high
Riverbank Protection[2]	-	curved alpine wood-rush spiked wood-rush	-	black alpine sedge	showy sedge	willow spp.

INTERPRETATION	VEGETATION TYPE NUMBER					
	7	8	9	10	11	12
Sensitivity of Vegetation Types[1]	very high	very high	high	high	high	moderate to high
Riverbank Protection[2]	willow spp.	blueberry spp.	Pacific menziesia black blueberry	blueberry spp. white-flowered rhododendron	blueberry spp. white-flowered rhododendron	blueberry spp.

INTERPRETATION	VEGETATION TYPE NUMBER					
	13	14	15	16	17	18
Sensitivity of Vegetation Types[1]	moderate to high	moderate to high	moderate to high	moderate	moderate to high	low
Riverbank Protection[2]	twinberry honeysuckle willow spp. prickly rose soopolallie	twinberry honeysuckle willow spp. prickly rose soopolallie	bog willow bog glandular birch	devil's-club twinberry honeysuckle western thimbleberry blueberry spp.	willow spp.	prickly rose blueberry spp.

[1] Four sensitivity ratings were used to describe the sensitivity of each vegetatin type of disturbance. These include: very high, high, moderate and low. The ratings for each type were subjectively determined on the basis of their susceptibility to disturbance and expected rate of recovery.

[2] Plant species useful for the protection of riverbanks.

TABLE 5.1: (CONTINUED)

INTERPRETATION	VEGETATION TYPE NUMBER				
	19	20	21	22	23
Sensitivity of Vegetation Types[1]	moderate	moderate to low	moderate	moderate to high	high
Riverbank Protection[2]	common paper birch devil's-club western thimbleberry Rocky Mountain maple high bush cranberry twinberry honeysuckle prickly rose	common paper birch black cottonwood twinberry honeysuckle red-osier dogwood high bush cranberry western thimbleberry thin-leaved mountain alder trembling aspen Saskatoon	common paper birch trembling aspen Saskatoon western thimbleberry twinberry honeysuckle high bush cranberry soopolallie prickly rose	bog glandular birch common Labrador tea	-

INTERPRETATION	VEGETATION TYPE NUMBER				
	24	25	26	27	28
Sensitivity of Vegetation Types[1]	moderate	moderate	moderate	low	moderate
Riverbank Protection[2]	western red cedar devil's-club blueberry spp. western thimbleberry Rocky Mountain maple Pacific menziesia high bush cranberry twinberry honeysuckle	western red cedar blueberry spp. Pacific menziesia common paper birch	western red cedar black blueberry Saskatoon high bush cranberry Pacific menziesia	common paper birch trembling aspen Rocky Mountain maple Sitka willow western thimbleberry red-osier dogwood Saskatoon twinberry honeysuckle highbush cranberry Sitka mountain alder	bog glandular birch willow spp. common Labrador tea

[1] Four sensitivity ratings were used to describe the sensitivity or each vegetatin type of disturbance. These include: very high, high, moderate and low. The ratings for each type were subjectively determined on the basis of their susceptibility to disturbance and expected rate of recovery.

[2] Plant species useful for the protection of riverbanks.

TABLE 5.2: VEGETATION INTERPRETATIONS FOR FORESTRY

INTERPRETATIONS	VEGETATION TYPE NUMBER						
	1	2	3	4	5	6	7
Windthrow Hazard	N/A	N/A	N/A	N/A	N/A	N/A	low to moderate
Shrub-Seedling Competition	N/A	N/A	N/A	N/A	N/A	N/A	low
Regeneration Problems	severe climate high elevation	severe climate high elevation	severe climate high elevation	severe climate high elevation	climate high elevation wet soils	climate high elevation wet soils	climate high elevation late snow retention
Potential for Natural Regeneration	NIL	NIL	NIL	NIL	very low	very low	low
Recommended Tree Species	N/A	N/A	N/A	N/A	N/A	N/A	Engelmann spruce alpine fir lodgepole pine
Nutrient Cycling	very slow	extremely slow	extremely slow	extremely slow	very slow	very slow	slow
Forest Capability	N/A	N/A	N/A	N/A	N/A	N/A	NC
Fire Hazard (Historical)	low to NIL	low to NIL	low to NIL	low to NIL	low	low	moderate
Slash Disposal and Prescribed Burning Guidelines	N/A	N/A	N/A	N/A	N/A	N/A	avoid

TABLE 5.2: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER						
	8	9	10	11	12	13	14
Windthrow Hazard	low to moderate	low to moderate	low to moderate	low to moderate	low to moderate	high	moderate to high
Shrub-Seedling Competition	low	low to moderate	moderate	moderate to high	low	moderate	moderate
Regeneration Problems	climate high elevation late snow retention	soil moisture deficits					frost heaving on silty and clayey materials
Potential for Natural Regeneration	low	moderate	moderate to high	moderate to high	moderate to high	moderate to high	moderate
Recommended Tree Species	Engelmann spruce alpine fir lodgepole pine	lodgepole pine	lodgepole pine Engelmann spruce alpine fir	lodgepole pine Engelmann spruce alpine fir	lodgepole pine Engelmann spruce alpine fir	Engelmann spruce	Engelmann spruce white spruce
Nutrient Cycling	very slow	slow[1]	slow to normal	normal	normal	normal to rapid	normal
Forest Capability	NC	low	low to moderate	low to moderate	low to moderate	moderate	low to moderate
Fire Hazard (Historical)	moderate	high	moderate	moderate	moderate	low to moderate	moderate
Slash Disposal and Prescribed Burning Guidelines	avoid	avoid	light intensity broadcast burn or spot burn	light intensity broadcast burn	light intensity broadcast burn or spot burn	moderate intensity broadcast burn	light intensity broadcast burn or spot burn

TABLE 5.2: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER						
	15	16	17	18	19	20	21
Windthrow Hazard	high	moderate to high	high	low to moderate	low to moderate	moderate to high	low to moderate
Shrub-Seedling Competition	high	high	moderate to high	low	high	high	moderate
Regeneration Problems	high water table	frost[1] heaving	high water table frost heaving	soil moisture deficits		frost[1] heaving	soil moisture deficits
Potential for Natural Regeneration	low	moderate to high	moderate to high	moderate	low to moderate	moderate to high	low to moderate
Recommended Tree Species	non-forested	white spruce alpine fir Engelmann spruce	white spruce	lodgepole pine	white spruce alpine fir western red cedar Rocky Mountain Douglas-fir	white spruce alpine fir trembling aspen black cottonwood	lodgepole pine white spruce alpine fir
Nutrient Cycling	slow	normal	slow	slow[1]	normal[2] to rapid	rapid[2]	normal[1]
Forest Capability	NC	moderate	NC	low	moderate to high	high	moderate
Fire Hazard (Historical)	very low	moderate	very low	high	moderate to low	moderate to low	high
Slash Disposal and Prescribed Burning Guidelines	N/A	spot burn or light intensity broadcast burn	moderate intensity broadcast burn	avoid	spot burn or avoid	spot burn or light intensity broadcast burn	avoid

TABLE 5.2: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER						
	22	23	24	25	26	27	28
Windthrow Hazard	high	high	moderate	high	moderate	low to moderate	high
Shrub-Seedling Competition	high	high	moderate to high	moderate	moderate	high	high
Regeneration Problems	high water table flooding	flooding high water table	frost[1] heaving	frost[1] heaving	soil moisture deficits	soil moisture deficits	high water table
Potential for Natural Regeneration	low	low	moderate to high	moderate to high	moderate to high	moderate	low
Recommended Tree Species	lodgepole pine black spruce	non-forested	white spruce Rocky Mountain Douglas-fir alpine fir western hemlock	white spruce alpine fir Rocky Mountain Douglas-fir western hemlock lodgepole pine	white spruce Rocky Mountain Douglas-fir alpine fir lodgepole pine western hemlock	lodgepole pine Rocky Mountain Douglas-fir trembling aspen paper birch	black spruce lodgepole pine
Nutrient Cycling	slow	slow	rapid	normal	rapid[1]	normal to rapid	slow
Forest Capability	low	NC	moderate to high	moderate	high	moderate	very low
Fire Hazard (Historical)	low to moderate	very low	moderate	moderate	moderate to high	high	low
Slash Disposal and Prescribed Burning Guidelines	avoid	avoid	spot burn or light intensity broadcast burn	light or medium intensity broadcast burn	spot or light intensity broadcast burn	avoid	avoid

[1] Soil organic horizons (L, F and H) are very important as a nutrient pool. Vegetation is obtaining a large proportion of nutrients from these organic horizons on coarse textured soils. Destruction of these organic horizons will severely reduce productivity of these ecosystems

[2] Sites enriched by both moisture and nutrients carried by subsurface seepage water. This may compensate for the effects of coarse textured soils

[3] Ratings used in these tables are outlined in the text.

5.4.2 SHRUB-SEEDLING COMPETITION

The degree of shrub competition expected following the clearing of each type is predicted on the basis of presence and abundance of shrub species in each type. The degree of shrub competition will vary depending on the treatment of the sites and the bud and seed banks which remain following clearing and other treatments. In general, ecosystems which have abundant soil moisture (e.g. hygric moisture regimes) have moderate to high brush hazards due to an abundance of potential brush species, the difficulty of reducing seed and bud banks through site treatment for development of a continuous brush canopy. In these situations, it may be necessary to plant as soon after harvesting as possible, perhaps using larger planting stock.

Shrub species play an important role in rehabilitating disturbed ecosystems through maintaining soil stability, possibly reducing excessive leaching losses of soil nutrients, rebuilding soil organic matter, and nutrient cycling. Species which fix nitrogen, such as alder and soopolallie, might be used to reduce nitrogen deficiencies common to forest ecosystems in this area. Alder may, in some cases, present a serious brush hazard, however, possible losses in forest growth may be more than offset by increases in productivity due to improved nutrient status of the site.

5.4.3 REGENERATION PROBLEMS

In Table 5.2, possible regeneration problems are indicated for each type. Factors considered here are climatic constraints related to the short growing season occurring at high elevations, moisture deficits due to coarse textured or shallow soils, and high water tables causing saturated soil conditions. In the Krummholz subzone, regeneration may also be limited in areas of late snow retention. The typical mosaic of tree cover in this subzone is the result of the effect of existing tree cover on snowmelt and is the result of the restriction of tree establishment to hummocks where snowmelt occurs sufficiently early in the growing season. Re-establishment of tree cover following disturbance or clearing would be most successful on hummocks or raised areas.

5.4.4 POTENTIAL FOR NATURAL REGENERATION

The potential for natural regeneration is considered in relation to the site conditions represented by each type. It is a subjective estimate based on climate, soil moisture conditions, and the species present.

5.4.5 RECOMMENDED TREE SPECIES

Tree species appropriate to the environmental conditions of each vegetation type are recommended on the basis of their performance recorded in sample plots. The choice of these, or other possible species for any site, will depend on management objectives and site treatment. Where planting stock is used to regenerate sites, appropriate provenances should be used.

5.4.6 NUTRIENT CYCLING

The rate of nutrient cycling is subjectively estimated for each vegetation type. This assessment is based on estimates of the relative rate of accumulation and decomposition of organic matter and the available soil nutrient pool. The rate of nutrient cycling is influenced by climate, soil moisture, and the abundance of nutrients available in the soil for biomass production.

Nutrient cycling is extremely slow in most vegetation types of the Alpine tundra zone due to cold temperatures which limit biomass production and decomposition. Site moisture deficits in some vegetation types limit the rate of nutrient cycling by limiting biomass production, litterfall, and decomposition rates. Excessive soil moisture, such as occurs in bogs, limits the rate of nutrient cycling through the creation of anaerobic conditions which limit decomposition rates and lead to the accumulation of organic material. In addition, losses of nitrogen and sulfur occur through anaerobic respiration.

Rapid rates of nutrient cycling are found in several types in the interior western red cedar - western hemlock zone due to high litterfall production, relatively rapid decomposition, and, in several types, enrichment of the soil nutrient pool by subsurface seepage.

5.4.7 FOREST CAPABILITY

Five generalized capability classes (Vold et al., 1977) are recognized in Table 5.2 and were determined using calculated Site Index Values for each tree species present in each vegetation type. The classes used and their approximate equivalents to the Canada Land Inventory are given in Table 5.3.

Types in the Alpine tundra zone and in the krummholz subzone have no to very low forest capability due to climatic constraints. Capability ranges from low to moderate in the forested subzone of the Subalpine Engelmann spruce - alpine fir zone and from very low to high in the interior western red cedar - white spruce and interior western hemlock - western red cedar zones.

TABLE 5.3: FOREST CAPABILITY CLASSES IN RELATION TO BCMF SITE CLASSES AND CLI FOREST CAPABILITY CLASSES (after ELUSC, 1978)

Forest Capability Class	Site Class (BCMF)	CLI Forest[1] Capability Class
NC (very low)	Low	6-7
Low	Poor	5-6
Low to Moderate	Medium	4-5
Moderate	Good	3-4
High	Good[2] (very)	1-2

[1] The indicated CLI classses are only approximate, from ELUSC (1978).

[2] For the purpose of this report, high forest capability represents the upper half of the "Good" site class.

5.4.8 FIRE HAZARD (HISTORICAL)

Fire hazard is assessed relative to the apparent frequency of fire in each of the vegetative types. It is a subjective rating closesly related to available moisture on the sites and the flammability of the ecosystems. Fire hazards are generally high in dry lodgepole pine vegetation types (types 9, 18, 21 and 27) and low to very low in bog types.

5.4.9 SLASH DISPOSAL AND PRESCRIBED BURNING GUIDELINES

Guidelines are provided in Table 5.2 for levels of prescribed burning which should not cause serious damage to the ecosystems. They are intended to be assessed prior to harvesting so that ap propriate steps can be taken during harvesting or treatments planned which will not cause serious harm to the productive capacity of the site. These are not recommendations for each of the vegetation types. The final decisions regarding slash disposal will depend on site specific evaluations of slash accumulation, potential brush hazards, and the likelihood of damaging the productive capacity of the site.

Factors considered in developing these guide lines include depth of soil organic matter, importance of soil organic horizons to the nutrient pool and moisture retention of the site, depth to water table, and possible need to reduce shrub cover.

5.5 VEGETATION INTERPRETATIONS FOR MINE RECLAMATION

The interpretations presented in the following sections are intended for use in the reclamation of all areas, including mine sites, haul roads and exploration roads, which have been disturbed.

The coal-bearing areas of the Study Area are found primarily in the Rocky Mountain Foothills which include the Subalpine Engelmann spruce - alpine fir zones of the Subboreal and Boreal Regions. Therefore, the interpretations presented in Sections 5.5.1 and 5.5.2 will apply primarily to the Subalpine Engelmann spruce - alpine fir zone of the study area.

5.5.1 SPECIES SUITABILITY FOR RECLAMATION

The species which are selected for revegetation of an area should reflect the long-term land use objectives and a knowledge of the growth characteristics, longevity and reproduction potential of each species (Berg, 1974).

In deciding which plant species would be most suitable for the revegetation of a mined area, one must first decide what the intended use is to be of the reclaimed land. In most cases, the immediate objective will be to establish a ground cover both for aesthetics and for erosion control. A more long-term objective might be to establish forage species for big game or domestic livestock. Once the intended use has been decided on, the land manager can then determine which species, and in what proportions, are to be planted on a mined site.

Although non-native species have been used for the revegetation of mined areas in the past, it is strongly suggested that, where possible, native species should be used. Non-native species have been used because of their commercial availability, their rapid germination and their affinity for disturbed sites (ELUSC, 1978). Non-native species, however, are often unable to adapt to local conditions over a long period of time and, as a result, tend to form unstable plant communities. Native species, on the other hand, are more likely to develop into stable communities as they are the product of years of biological selection for harsh environments. Their disadvantage is that they are of limited commercial availability at the present time. This is becoming less of a problem, however, and it is hoped that, in the near future, all of the native species in demand for reclamation purposes will become available commercially.

When selecting seed of native species for revegetation, the seed of vegetation which is established on the oldest disturbed sites in the particular ecological or altitudinal zone in which the mine is located should be selected (Peterson and Etter, 1970). In addition, Dick (1974) states that seedlings should always be planted within 150 metres (500 ft) of elevation from which the seeds or cuttings were collected. Because of the considerable site differences within the subalpine which are significant to plant growth, Berg (1974) suggests that the species which are seeded should be selected for the adaptation to individual sites within the subalpine. Many researchers are now finding that mixes of species are advantageous both from aesthetic standpoints and for the stability of the plant community.

Table 5.4 lists a number of native plant species which are suggested as suitable for the reclamation of subalpine mine sites.

5.5.2 EROSION PREVENTION

Revegetation of a disturbed area is particularly important because of its value in the prevention and control of erosion. Peterson and Etter (1970) suggest that, in mountainous regions, revegetation should be undertaken as soon as possible following a disturbance so that the finer soil particles will be prevented from washing downhill or into the profile.

For many years, researchers have shown that a mixture of grasses and legumes is particularly valuable in the stabilizing of mine surface materials. Dick (1974), however, states that a mixture of woody and herbaceous species will achieve much greater ground cover and, therefore, greater stability of the surface materials than pure stands of either type of vegetation. In addition, Dick suggests that trees and shrubs are more effective than herbaceous growth in preventing erosion due to their deeper rooting ability which is valuable in providing mechanical support for soil.

Table 5.4 indicates which species are particularly useful for erosion prevention of disturbed areas in the Subalpine Engelmann spruce - alpine fir zone of the study area.

5.6 VEGETATION INTERPRETATIONS FOR RECREATION

Outdoor recreation in the Southeast Extension Study Area is discussed in considerable detail in the report entitled Outdoor Recreation Resources of the Northeast Coal Study Area, 1977-1978 (Sky, 1979).

The interpretations which are discussed in Table 5.5 and in the separate sub-sections of Section 5.6 of this report deal with recreation in terms of the vegetation resources of the Study Area. It is hoped that the information presented in this section will be of use to both the experienced park planner and to the outdoor recreationist.

TABLE 5.4: NATIVE PLANT SPECIES SUITABLE FOR RECLAMATION OF SUBALPINE MINE SITES

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
TREES					
Abies lasiocarpa	alpine fir	coniferous tree 7 8 9 10 11 12 13 14	conifers are "acid loving" (preferred pH range is 4.5-6.0)	aesthetics, wildlife cover	Low drought tolerance. Do not plant on south-facing slopes.
Picea engelmannii	Engelmann spruce	coniferous tree 7 8 9 10 11 12 13 14	prefer acidic bedrock such as quartzite and schist	aesthetics, wildlife cover	Do not plant on south-facing slopes. Well suited for high elevation reclamation - superior survival rate over 5000 feet.
Picea glauca	white spruce	coniferous tree 11 12	high	aesthetics, wildlife cover	Occurs in Forested subzone. Moderate drought tolerance. May be planted on south-facing slopes.
Pinus albicaulus	whitebark pine	coniferous tree 8 9 11	high	aesthetics, wildlife cover	Moderate to high drought tolerance. May be planted on south-facing slopes. Present in Forested and Krummholz subzones.
Pinus contorta	lodgepole pine	coniferous tree 7 9 10 11 12 14	high	aesthetics, wildlife cover	May be planted on south-facing slopes. Reacts well to browsing pressures. High drought tolerance.
Populus tremuloides	trembling aspen	deciduous tree	thought to have a low acid tolerance	ground cover, wildlife food, erosion control, aesthetics	Moderate drought tolerance, therefore, of value for planting on south-and southwest-facing slopes. Ability to reproduce vegetatively by suckering.
Populus balsamifera ssp. trichocarpa	black cottonwood	deciduous tree 7 14	low	ground cover, moderate wildlife food	Valuable for revegetation of minedareas up to 1370-1520 m (4500-5000 ft) elevation.
SHRUBS					
Alnus viridis ssp. sinuata	Sitka mountain alder	small shrub 8 10 13	moderate	erosion control, nitrogen fixing	Found in Forested subzone. Can be planted on all aspects except south aspect as susceptible to drought.
Alnus incana	thin-leaved mountain alder	shrub 12 14	moderate	erosion control, nitrogen fixing	Fairly tolerant of drought. Found in Forested subzone. Can be planted on all aspects.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Betula glandulosa	bog glandular birch	shrub 7 12 10 14 15	high	erosion control, wildlife food	Low tolerance of drought. Found in both Krummholz and Forested subzones.
Juniperus communis	common juniper	evergreen shrub 7 8 10 14	seems to prefer calcareous bedrock, ie. limestone	aesthetics, wildlife food	Found in Krummholz subzone. Appears to be drought tolerant.
Menziesia ferruginea	Pacific menziesia	small shrub 8 9 10 11 12 13	seems to prefer more acidic bedrock ie. quartzite schist	ground cover	Moderate drought tolerance. Found in both Krummholz and Forested subzones.
Rhododendron albiflorum	white-flowered rhododendron	shrub 7 8 10 11	moderate	aesthetics, erosion control	Low tolerance of drought. Sometimes forms dense thickets which may inhibit growth of conifer seedlings. Found in both Krummholz and Forested subzones.
Rosa spp. (Rosa acicularis)	wild rose spp. (prickly rose)	small shrub 7 14	high (Rosa acicularis)	ground cover, erosion control, wildlife browse	Rosa acicularis has moderate drought tolerance. Found in both Forested and Krummholz subzones.
Salix spp.	willow spp.	shrub 5 6 7 9 10 11 12 13 14 15	moderate	erosion control, aesthetics, excellent game and domestic animal food	Do not tolerate drought well. Present in Forested and Krummholz subzones. Salix spp. specific to site should be used where possible.
Sambucus racemosa	elderberry	tall shrub 5 11 13	seems to prefer more acidic soil conditions	wildlife food, erosion control	Present in Forested and Krummholz subzones. Low to moderate drought tolerance.
Shepherdia canadensis	soopolallie	shrub 7 14	moderate	aesthetics, nitrogen fixation, erosion control	Moderate drought tolerance. Present in Krummholz and Forested subzones.
HERBS Achillea millefolium	yarrow	herb 7 14	seems to prefer calcareous soil conditions	erosion control, ground cover, wildlife food	Moderate to high drought tolerance. Occurs in Krummholz and Forested subzones.
Arctostaphylos rubra	red manzanita	trailing perennial herb 7	high	erosion control, ground cover, wildlife food	Less drought tolerant than kinnikinnick. Present in Krummholz subzone.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Arctostaphylos uva-ursi	kinnikinnick	trailing perennial herb 7	moderate	erosion control, ground cover, wildlife food	Very high drought tolerance. Present in Krummholz subzone.
Artemisia arctica	boreal mugwort	herb 5 6 7 8 10	variable	possible wildlife food, ground cover, erosion control	Moderate drought tolerance. Occurs in Krummholz and Forested subzones.
Aster conspicuus	showy aster	herb 14	variable	aesthetics, erosion control, wildlife food	Moderate drought tolerance. Present in Forested subzone.
Aster foliaceous	leafy-bracted aster	herb 15	seems to prefer acidic soil conditions	aesthetics, erosion control, wildlife food	Low drought tolerance. Present in Forested subzone.
Aster modestus	great northern aster	herb 5	seems to prefer more acidic soil conditions	aesthetics, erosion control, wildlife food	Moderate drought tolerance. Present in Krummholz subzone.
Aster sibiricus	Siberian aster	herb 7	seems to prefer calcareous soil conditions	aesthetics, erosion control, wildlife food	Moderate to high drought tolerance. Present in Krummholz subzone.
Aster subspicatus	Douglas' aster	herb 15	seems to prefer more acidic soil conditions	aesthetics, erosion control, wildlife food	Low drought tolerance. Occurs in Forested subzone.
Bistorta vivipara	alpine bistort	small herb 5 6 7	variable	erosion control, ground cover	Moderate to high drought tolerance. Occurs in Krummholz subzone.
Caltha leptosepala	white marsh-marigold	herb 6 10	seems to prefer acidic soil conditions	aesthetics, ground cover, wildlife food	Low drought tolerance. Present in Krummholz and Forested subzones.
Dryas drummondii	yellow mountain-avens	trailing herb 7	seems to prefer calcareous soil conditions	erosion control, ground cover, nitrogen fixing	Moderate to high drought tolerance. Occurs in Krummholz subzone.
Dryas integrifolia	entire-leaved white mountain-avens	trailing herb 7	seems to prefer calcareous soil conditions	erosion control, ground cover, nitrogen fixing	Moderate to high drought tolerance. Occurs in Krummholz subzone.
Epilobium anagallidifolium	alpine willowherb	perennial herb 5 6 10 12 13	variable	erosion control, aesthetics, ground cover, wildlife food	High drought tolerance. Present in both Krummholz and Forested subzones.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Epilobium angustifolium	fireweed	perennial herb 5 7 10 11 12 13 14 15	variable	erosion control, aesthetics, ground cover, wildlife food	Low drought tolerance. Present in Forested and Krummholz subzones.
Epilobium ciliatum	purple-leaved willowherb	perennial herb 13	variable	erosion control, aesthetics, ground cover, wildlife food	High drought tolerance. Occurs in Forested subzone.
Epilobium lactiflorum		perennial herb 5	variable	erosion control, aesthetics, ground cover, wildlife food	High drought tolerance. Occurs in Krummholz subzone.
Equisetum arvense	common horsetail	herb 5 6 7 8 10 11 12 13 14 15	variable	erosion control, aesthetics, ground cover, wildlife food	Moderate drought tolerance. Present in both Krummholz and Forested subzones.
Erigeron peregrinus	subalpine fleabane	herb 5 6 7 8 10 12 14	variable	aesthetics, ground cover, wildlife food, erosion control	Moderate drought tolerance. Occurs in Krummholz and Forested subzones.
Hedysarum alpinum	alpine hedysarum	perennial herb 7	low	aesthetics, ground cover, nitrogen fixing, wildlife food	Moderate drought tolerance. Present in Krummholz subzone.
Heracleum sphondylium	common cow-parsnip	perennial herb 5 6 7 10 12 13 14	variable	aesthetics, ground cover, wildlife food	Low drought tolerance. Present in both Krummholz and Forested subzones.
Lathyrus ochroleucus	cream-coloured peavine	perennial herb 14	restricted to near neutral pH ranges	aesthetics, ground cover, erosion control, wildlife food, nitrogen fixing	Moderate drought tolerance. Present in Krummholz subzone.
Lupinus nootkatensis	Nootka lupine	perennial herb 5 6 10 13	variable	aesthetics, erosion control, wildlife food, nitrogen fixing	Moderate drought tolerance. Occurs in both Krummholz and Forested subzones.
Osmorhiza chilensis	mountain sweetcicely	perrenial herb 5 10 13 14	variable	ground cover, erosion control, wildlife food	Low to moderate drought tolerance. Present in Krummholz and Forested subzones.
Saxifraga lyallii	Lyall's saxifrage	perennial herb 5	seems to prefer more acidic soil conditions	ground cover, erosion control, aesthetics	Moderate to high drought tolerance. Occurs in Krummholz subzone.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Sedum lanceolatum	lance-leaved stonecrop	perennial herb 7	seems to prefer calcareous soil conditions	ground cover, erosion control, aesthetics	Moderate to high drought tolerance. Occurs in Krummholz subzone.
Solidago multiradiata	northern goldenrod	perennial herb 7 8	variable	aesthetics, erosion control, wildlife food	Moderate drought tolerance. Present in Krummholz subzone.
Spiraea betulifolia	birch-leaved spirea	small, woody perennial 9	moderate	ground cover, wildlife food, erosion control	Appears to be tolerant of drought. Occurs in Forested subzone.
Vaccinium vitis-idaea	mountain cranberry	trailing perennial herb 7 8	variable	ground cover, wildlife food, erosion control	Moderate drought tolerance. Present in Krummholz subzone.
Veronica wormskjoldii	alpine speedwell	herb 5 6 15	moderate	ground cover, aesthetics, erosion control	Moderate drought tolerance. Occurs in both Krummholz and Forested subzones.
GRASSES, SEDGES & RUSHES Agropyron pauciflorum	slender wheat grass	tufted perennial grass 7	low	erosion control, wildlife food	Moderate to high drought tolerance. Present in Krummholz subzone.
Agrostis mertensii	northern bent grass	perennial tufted grass 15	moderate to high	erosion cover, wildlife food	Low to moderate drought tolerance. Present in Forested subzone.
Agrostis scabra	hair bent brass	tufted perennial bunchgrass 15	high	ground cover, erosion control	Moderate drought tolerance. Present in Forested subzone.
Agrostis thurberiana	Thurber's bent grass	perennial grass 6 15	seems to prefer acidic soil conditions	ground cover, erosion control	Low to moderate drought tolerance. Present in both Forested and Krummholz subzones.
Bromus inermis	Pumpelly brome grass	medium to tall grass 7	low	erosion control, wildlife food	Moderate drought tolerance but does best on moist soils. Occurs in Krummholz subzone.
Calamagrostis canadensis	bluejoint small reed grass	tall, rhizomatous, perennial grass 5 6 7 8 10 12 13 14 15	high	ground cover, erosion control, wildlife food	Cannot germinate under droughty conditions but has high drought tolerance once established. Occurs in both Krummholz and Forested subzones.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Carex spp.	sedge spp.	sedge spp. 5 6 7 8 10 15	variable	erosion control, wildlife food	Variable drought tolerance depending on Carex sp. considered. Present in both Krummholz and Forested subzones.
Cinna latifolia	wood reed grass	rhizomatous perennial grass 5 13	moderate	erosion control, wildlife food	Low drought tolerance. Occurs in both Krummholz and Forested subzones.
Deschampsia cespitosa	tufted hair grass	densely tufted perennial bunchgrass 6	variable	ground cover, wildlife food, erosion control	Moderate drought tolerance though this species prefers moist locations. Occurs in Krummholz subzone.
Elymus glaucus	blue wild rye grass	grass 5 10 12	seems to prefer acidic soil conditions	ground cover, wildlife food	Moderate to high drought tolerance. Present in both Krummholz and Forested subzones.
Elymus innovatus	fuzzy-spiked wild rye grass	perennial grass 7 10 14	variable	erosion control and soil stabilization	Low drought tolerance. Occurs in both Krummholz and Forested subzones.
Eriophorum angustifolium	narrow-leaved cotton-grass	perennial cottongrass 6 15	high	erosion control, aesthetics	Low drought tolerance. Present in both Krummholz and Forested subzones.
Festuca altaica	Altai fescue	perennial tufted grass 6 7	variable	ground cover, erosion control, wildlife food	High drought tolerance. Occurs in Krummholz subzone.
Festuca brachyphylla	alpine fescue	tufted perennial grass 7	seems to prefer calcareous soil conditions	ground cover, wildlife food	High drought tolerance. Present in Krummholz subzone.
Festuca subuliflora	crinkle-awned fescue	perennial grass 12 13	moderate	wildlife food, ground cover, may be useful for erosion control	Moderate drought tolerance. Occurs in Forested subzone.
Juncus drummondii	Drummond's rush	perennial rush 5	seems to prefer acidic soil conditions	erosion control, ground cover, wildlife food	Moderate drought tolerance. Present in Krummholz subzone.
Juncus mertensianus	Mertens' rush	perennial rush 6	seems to prefer acidic soil conditions	erosion control, ground cover, wildlife food	Low drought tolerance. Present in Krummholz subzone.

TABLE 5.4: (CONTINUED)

SPECIES NAME		PLANT GROWTH HABITAT AND TYPE NUMBER	ACID TOLERANCE	USES	COMMENTS
SCIENTIFIC	COMMON				
Luzula parviflora	small-flowered wood-rush	perennial rush 6 10 11	seems to prefer acidic soil conditions	wildlife food, ground cover	Moderate to high drought tolerance. Present in both Krummholz and Forested Subzones.
Luzula piperi	Piper's wood-rush	perennial rush 5 7 10	variable	erosion control, wildlife food	Moderate drought tolerance. Present in both Krummholz and Forested subzones.
Phleum alpinum	alpine timothy	perennial bunchgrass 5 6	high	erosion control, wildlife food	High drought tolerance. Occurs in Krummholz subzone.
Poa alpina	alpine blue grass	perennial grass 5 6 7	high	erosion control, ground cover, wildlife food	High drought tolerance. Occurs in Krummholz subzone.
Poa arctica	arctic blue grass	rhizomatous perennial grass 8	seems to prefer acidic soil conditions	erosion control, wildlife food	Moderate drought tolerance. Present in Krummholz subzone.
Poa cusickii	Cusick's blue grass	tufted perennial grass 7	seems to prefer calcareous soil conditions	erosion control, wildlife food	High drought tolerance. Present in Krummholz subzone.
Poa glauca	glaucous blue grass	tufted perennial grass 5	seems to prefer acidic soil conditions	erosion control, wildlife food	High drought tolerance. Occurs in Krummholz subzone.
Poa leptocoma	bog blue grass	tufted perennial grass 5	seems to prefer acidic soil conditions	ground cover, wildlife food	Low drought tolerance. Present in Krummholz subzone.
Poa marcida	weak blue grass	tufted perennial grass 5	seems to prefer acidic soil conditions	ground cover, wildlife food	Low drought tolerance. Present in Krummholz subzone.
Poa reflexa	nodding blue grass	tufted perennial grass 6	appears to prefer more acidic soil conditions	ground cover, erosion control, wildlife food	Moderate drought tolerance. Occurs in Krummholz subzone.
Vahlodea atropurpurea	mountain vahlodea	perennial grass 5 6 8 10 11 12 13 14	variable	ground cover, erosion control, wildlife food	Low to moderate drought tolerance. Present in both Krummholz and Forested Subzones.

Note:
1. Species listed in Table 5.4 are taken from the data collected by the vegetation survey of the Southeast Extension of the Northeast Coal Area in 1977.
2. Nomenclature of plant species follows that of Taylor, R. L. and B. MacBryde. 1977. Vascular Plants of British Columbia. A Descriptive Resource Inventory. Technical Bulletin No. 4. University of British Columbia Press. Vancouver, British Columbia.
3. After Berg (1974); Dick (1978, 1974); Watson, Parker and Polster (1980).

5.6.1 COLOURFUL AND UNIQUE VEGETATION

Several unique vegetation types are indicated in Table 5.5. These include mainly alpine tundra types, subalpine meadows and krummholz types, the boreal vegetation type, and bog types.

The colourful vegetation types which are listed in Table 5.5 are determined by the presence of colourful flowering plants and by vegetation which is particularly colourful during autumn (i.e. trembling aspen, black cottonwood, red-osier dogwood, blueberry spp., etc.).

5.6.2 EDIBLE PLANT DISTRIBUTION

The edible plants listed in Table 5.5 are mainly those plants which have edible berries. Common Labrador tea is also indicated as the leaves of this plant can be dried and used for making a fragrant drink. In addition, several vegetation types have mountain sweetcicely or hemlock water parsnip listed as an edible plant. This is because the roots of these plants are cooked and eaten like the domestic parsnip. When harvesting the hemlock water-parsnip, one should be extremely careful not to confuse it with the very poisonous water hemlock (Cicuta douglasii).

5.6.3 NUISANCE AND POISONOUS PLANT DISTRIBUTION

The nuisance plants and poisonous plants which have been identified in the Study Area are listed in Table 5.5. Devil's-club is the only nuisance plant listed. All other plants listed in the table are very poisonous.

5.6.4 TRAFFICABILITY

The trafficability of each vegetation type (indicated in Table 5.5) was determined by subjectively estimating the sensitivity of each type to disturbance by trampling. For example, the trafficability rating for Type 1 is low due to the fact that this type has a high sensitivity to disturbance by trampling.

5.6.5 EXPECTED RATE OF REVEGETATION FOLLOWING DISTURBANCE

The expected rate of revegetation of each vegetation type following disturbance is indicated in Table 5.5. The rates which are listed in the table are very general approximations of the time it would take to revegetate the types after disturbance. Naturally, the length of time would depend on the degree of disturbance.

TABLE 5.5: VEGETATION INTERPRETATIONS FOR RECREATION

INTERPRETATIONS	VEGETATION TYPE NUMBER						
	1	2	3	4	5	6	7
Colourful[1] and Unique Vegetation	C, U	C, U	C, U	VC	VC, U	VC, U	C, U
Edible Plant Distribution	-	-	black crowberry	-	-		black crowberry soopolallie prickly rose mountain cranberry wild strawberry dwarf red blackberry common Labrador tea
Nuisance and Poisonous Plant Distribution	-	-	-	-	green false hellebore	western swamp kalmia fragrant white rein orchid	fragrant white rein orchid
Trafficability	low	low	low	low	low	low	low to moderate
Expected Rate of Revegetation Following Disturbance	very slow (ie. hundreds of years)	very slow	very slow	very slow	slow	slow	slow

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[1] C = colourful, VC = very colourful, U = unique

TABLE 5.5 (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER					
	8	9	10	11	12	13
Colourful[1] and Unique Vegetation	C, U	C, U	VC	C	C	C
Edible Plant Distribution	black blueberry oval-leaved blueberry five-leaved creeping raspberry black crowberry	black blueberry	black blueberry oval-leaved blueberry mountain sweetcicely five-leaved creeping raspberry	black blueberry oval-leaved blueberry five-leaved creeping raspberry	black blueberry oval-leaved blueberry black swamp gooseberry five-leaved creeping raspberry	black swamp gooseberry oval-leaved blueberry western thimbleberry black blueberry mountain sweetcicely five-leaved creeping raspberry
Nuisance and Poisonous Plant Distribution	fragrant white rein orchid	-	green false hellebore cucumberroot twistedstalk simple-stemmed twistedstalk	simple-stemmed twistedstalk green false hellebore	cucumberroot twistedstalk simple-stemmed twistedstalk	twinberry honeysuckle green false hellebore cucumberroot twistedstalk simple-stemmed twistedstalk
Trafficability	low to moderate	low to moderate	low to moderate	low to moderate	moderate	low to moderate
Expected Rate of Revegetation Following Disturbance	slow	slow	slow	slow	slow	slow

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[1] C = colourful, VC = very colourful, U = unique

TABLE 5.5: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER					
	14	15	16	17	18	19
Colourful[1] and Unique Vegetation	C	U	C	U	U	C
Edible Plant Distribution	soopolallie black swamp gooseberry prickly rose high bush cranberry wild strawberry mountain sweetcicely dwarf red blackberry five-leaved raspberry	bog cranberry black crowberry	black swamp gooseberry oval-leaved blueberry five-leaved creeping raspberry western thimbleberry black blueberry	-	velvet-leaved blueberry common Labrador tea prickly rose mountain cranberry red-osier dogwood oval-leaved blueberry black crowberry	western thimbleberry black swamp gooseberry high bush cranberry black blueberry dwarf red blackberry five-leaved creeping raspberry
Nuisance and Poisonous Plant Distribution	twinberry honeysuckle	fragrant white rein orchid	devils's-club simple-stemmed twistedstalk twinberry honeysuckle cucumberroot twistedstalk green false hellebore	-	twinberry honeysuckle	devil's-club twinberry honeysuckle cucumberroot twistedstalk simple-stemmed twistedstalk
Trafficability	moderate	low	moderate	low	moderate	moderate to high
Expected Rate of Revegetation Following Disturbance	slow	slow	moderate	slow	moderate	moderate to rapid

[1] C = colourful, VC = very colourful, U = unique

TABLE 5.5: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER				
	20	21	22	23	24
Colourful[1] and Unique Vegetation	VC	C	C, U	U	C
Edible Plant Distribution	red-osier dogwood high bush cranberry prickly rose western thimbleberry dwarf red blackberry common Saskatoon black swamp gooseberry moutain sweetcicely	soopolallie prickly rose western thimbleberry common Saskatoon high bush cranberry wild strawberry red-osier dogwood common Labrador tea	common Labrador tea bog cranberry prickly rose red-osier dogwood black swamp gooseberry mountain cranberry dwarf red blackberry	hemlock water-parsnip	black blueberry black swamp gooseberry oval-leaved blueberry five-leaved creeping raspberry high bush cranberry western thimbleberry
Nuisance and Poisonous Plant Distribution	simple-stemmed twistedstalk twinberry honeysuckle devil's-club cucumberroot twistedstalk	twinberry honeysuckle simple-stemmed twistedstalk	twinberry honeysuckle cucumberroot twistedstalk fragrant white rein orchid	-	devil's-club simple-stemmed twistedstalk twinberry honeysuckle cucumberroot twistedstalk green false hellebore
Trafficability	moderate	moderate to high	low	low	moderate to high
Expected Rate of Revegetation Following Disturbance	moderate to rapid	moderate to rapid	moderate	slow	moderate to rapid

[1] C = colourful, VC = very colourful, U = unique

TABLE 5.5: (CONTINUED)

INTERPRETATIONS	VEGETATION TYPE NUMBER			
	25	26	27	28
Colourful[1] and Unique Vegetation	C	C	C	C, U
Edible Plant Distribututton	oval-leaved blueberry black blueberry five-leaved creeping raspberry high bush cranberry black swamp gooseberry	black blueberry common Saskatoon high bush cranberry black swamp gooseberry five-leaved creeping raspbery	western thimbleberry red-osier dogwood prickly rose mountain sweetcicley soopolallie common Saskatoon high bush cranberry black blueberry	common Labrador tea bog cranberry mountain cranberry
Nusiance and Poisonus Plant Distribution	cucumberroot twistedstalk simple-stemmed twistedstalk	simple-stemmed twistedstalk	twinberry honeysuckle	western swamp kalmia
Trafficability	moderate to high	moderate to high	moderate	low
Expected Rate of Revegetation Following Disturbance	moderate	moderate	rapid	moderate

[1] C = colourful, VC = very colourful, U = unique

5.7 VEGETATION INTERPRETATIONS FOR WILDLIFE

5.7.1 PREFERRED SPECIES DISTRIBUTION

Tables 5.6 through 5.12 list the occurrence of major forage plants for each of the ungulate species occurring in the Study Area. Included in this list are plant species which frequently occur in the Study Area and which constantly occur in at least one vegetation type. Important ratings for each of the plants are from Blower (1982) and Singleton (1976). Where differences between the two existed, the ratings given by Blower (1982) were used.

Season of use is indicated as winter/spring (W) or summer/fall (S). The information on species utilized in summer is very limited (from Singleton, 1976) and as such the seasonal distinction must be regarded with caution. Winter forage is a major limiting factor to ungulates.

The occurrence of each of the forage plants in each vegetation type is indicated in relation to the probability of the species being present in areas of each type (based on their observed occurrence, ie. constancy, in each type).

The ratings given are:

R - occurs in less than 20% of the plots in the type; will only rarely be found in the type.
O - occurs in 20-55% of the plots in the type; will be found occasionally to frequently in the type.
C - occurs in more than 55% of the plots in the type; is constant, will probably occur in most representatives of the vegetation type

Species abundance has not been included in these tables. Further evaluation of the vegetation data could be useful in regard to this and to including additional forage species.

Factors other than forage availability have to be considered in assessing the value of any vegetation type for wildlife habitat. These include access, escape terrain, cover, water, snow accumulation, and forage quality.

TABLE 5.6: PREFERRED FORAGE SPECIES DISTRIBUTION - MULE DEER

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W	Amelanchier alnifolia (common Saskatoon)																				O	C			R	R	O	O	
	Moderate Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	O		C			C	O	R			C	C	O		
S	Aster spp. (asters)							O							R	R					R	C	O					C	
W	Betula papyrifera (common paper birch)																R			O	C	O			R	O	R	O	
W S	Carex spp. (sedges)			O	C	O	O		O							O		C					C	O					C
W	Cornus sericea (red-osier dogwood)										R								O		C	O	O		R			C	R
W S	Juniperus communis (common juniper)							C	O		R				O											O			
W	Populus tremuloides (trembling aspen)																			R	O	O					R	O	
W S	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	O			R		C		
W S	Ribes spp. (currents/gooseberries)					R					R	R	O	C	C		C			C	C	R	O		C	O	O	R	
W S	Rosa spp. (roses)							O							O				C	R	C	C	O		R			C	
W	Salix spp. (willows)					R	R	O		C		R	R	R	O	O				O	O							C	O
	Low Importance																												
W	Betula glandulosa (bog glandular birch)														R	C							C						C
W S	Festuca spp. (fescue grasses)	C	C	R				O																					
W	Lonicera involucrata (twinberry honeysuckle)													C	C	R	C		O	O	C	O	O		O	R	R	O	
W	Menziesia ferruginea (Pacific menziesia)								O	C	O	C	R	O			R				R	R	O		O	O	O	O	
W	Oplopanax horridus (devil's-club)																C			C	O				C		R		
W S	Poa spp. (blue grasses)	C	O	R	R	O	R	O																					
W S	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		O	O	R	R			C	C	O	O	

[1] W = winter and early spring, S = summer and fall.

[2] R = rarely, O = occasionally, C = constantly. See text for definitions.

TABLE 5.7: PREFERRED FORAGE SPECIES DISTRIBUTION - WHITETAIL DEER

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPE																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W S	Amelanchier alnifolia (common Saskatoon)																				0	C			R	R	0	0	
	Moderate Importance																												
W	Carex spp. (sedges)			0	C	0	0		0							0		C					C	0					C
W	Cornus sericea (red-osier dogwood)										R								0		C	0	0		R			C	R
W S	Festuca spp. (fescue grasses)	C	C	R				0																					
W	Populus tremuloides (trembling aspen)																			R	0	0					R	0	
W	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	0			R		C		
W S	Poa spp. (blue grasses)	C	0	R	R	0	R	0																					
W S	Rosa spp. (roses)							0							0				C	R	C	C	0		R			C	
W	Rubus pedatus (five-leaved creeping raspberry)				R				0		C	C	C	C	C		C			C	0				C	C	0		
W	Salix spp. (willows)					R	R	0		C		R	R	R	0	0				0	0							C	0
S	Spiraea betulifolia (birch-leaved spirea)									C								0	R	0		C			R	R	R	C	
W	Thuja plicata (western red cedar)																			0					C	0	C		
	Low Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	0		C			C	0	R			C	C	0		
W	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		0	0	R	R			C	C	0	0	

[1] W = winter and early spring, S = summer and fall

[2] R = rarely, 0 = occasionally, C = constantly. See text for definitions.

TABLE 5.8: PREFERRED FORAGE SPECIES DISTRIBUTION - MOOSE

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W	Amelanchier alnifolia (common Saskatoon)																				O	C			R	R	O	O	
W S	Betula glandulosa (bog glandular birch)														R	C							C						C
W S	Betula papyrifera (common paper birch)																R			O	C	O			R	O	R	O	
W S	Carex spp. (sedges)			O	C	O	O		O							O		C					C	O					C
W	Cornus sericea (red-osier dogwood)										R								O		C	O	O		R			C	R
W S	Salix spp. (willows)					R	R	O		C		R	R	R	O	O					O	O						C	O
	Moderate Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	O		C			C	O	R			C	C	O		
W S	Equisetum spp. (horsetails)					O	O	O	O		O	O	C	C	C	O	C			O	C		O		R	R		R	
W	Lonicera involucrata (twinberry honeysuckle)													C	C	R	C		O	O	C	C	O		O	R	R	O	R
W	Populus tremuloides (trembling aspen)																			R	O	O					R	O	
W	Thuja plicata (western red cedar)																			O					C	O	C		
W	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		O	O	R	R			C	C	O	O	
W	Viburnum edule (high bush cranberry)														O					O	C	C			O	O	O	O	R
	Low Importance																												
S	Epilobium angustifolium (fireweed)					O		O			O	O	C	O	C	O	C		C	R	O	O			R			O	
W	Menziesia ferruginea (Pacific menziesia)								O	C	O	C	R	O			R				R	R	O		O	O	O	O	
W	Oplopanax horridus (devil's-club)																C			C	O				C		R		
W	Pinus contorta (lodgepole pine)													O					C	R		O	C				O	O	R
W	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	O			R		C		

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[1] W = winter and early spring, S = summer and fall

[2] R = rarely, O = occasionally, C - constantly. See text for definitions.

TABLE 5.9: PREFERRED FORAGE SPECIES DISTRIBUTION - ROCKY MOUNTAIN ELK

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W	Amelanchier alnifolia (common Saskatoon)																				0	C			R	R	0	0	
W S	Festuca spp. (fescue grasses)	C	C	R				0																					
W																													
	Moderate Importance																												
S	Aster spp. (asters)							0							R	0					R	C	0					C	
W S	Betula glandulosa (bog glandular birch)														R	C							C						C
W S	Calamagrostis spp. (small reed grasses)					0	R	0	R		R		0	0	C	0	0		0		0	R	0	0	R			R	R
W S	Carex spp. (sedges)			0	C	0	0		0							0		C					C	0					C
W	Cornus sericea (red-osier dogwood)										R								0		C	0	0		R			C	R
W	Juniperus communis (common juniper)							C	0		R				0											0			
W	Oplopanax horridus (devil's-club)																C			C	0				C		R		
W	Pinus contorta (lodgepole pine)														0				C	R		0	C				0	0	R
W S	Poa spp. (blue grasses)	C	0	R	R	0	R	0																					
W S	Populus tremuloides (trembling aspen)																			R	0	0					R	0	
W S	Rosa spp. (roses)							0							0				C	R	C	C	0		R			C	
W S	Salix spp. (willows)					R	R	0		C		R	R	R	0	0				0	0							C	0
W	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		0	0	R	R			C	C	0	0	
W S	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	0			R		C		
	Low Importance																												
W S	Betula papyrifera (common paper birch)																R			0	C	0			R	0	R	0	
W	Lonicera involucrata (twinberry honeysuckle)													C	C	R	C		0	0	C	C	0		0	R	R	0	
W	Menziesia ferruginea (Pacific menziesia)								0	C	0	C	R	0			R				R	R	0		0	0	0	0	
W	Thuja plicata (western red cedar)																			0					C	0	C		
W	Tsuga heterophylla (western hemlock)											R													C	C	C		
W	Viburnum edule (high bush cranberry)														0					0	C	C			0	0	0	0	R

[1] W = winter and early spring, S = summer and fall

[2] R = rarely, O = occasionally, C = constantly. See text for definitions.

TABLE 5.10: PREFERRED FORAGE SPECIES DISTRIBUTION - BIGHORN SHEEP

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W	Carex spp. (sedges)			O	C	O	O		O							O		C					C	O					
W S	Festuca spp. (fescue grasses)	C	C	R				O																					
W S	Poa spp. (blue grasses)	C	O	R	R	O	R	O																					
	Moderate Importance																												
W	Amelanchier alnifolia (common Saskatoon)																				O	C			R	R	O	O	
W	Athyrium spp. (lady ferns)										R		O	O			O			C	O		O		O	O		R	
	Low Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	O		C			C	O	R			C	C	O		
W	Betula glandulosa (bog glandular birch)														R	C							C						C
W	Cornus sericea (red-osier dogwood)										R								O		C	O	O		R			C	R
W	Menziesia ferruginea (Pacific menziesia)								O	C	O	C	R	O			R				R	R	O		O	O	O	O	
W	Pinus contorta (lodgepole pine)														O				C	R		O	C				O	O	R
W	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	O			R		C		
W	Ribes spp. (currants/gooseberries)					R					R	R	O	C	C		C			C	C	R	O		C	O	O	R	
W	Rosa spp. (roses)							O							O				C	R	C	C	O		R			C	

[1] W = winter and early spring, S = summer and fall

[2] R = rarely, O = occasionally, C = constantly. See text for definitions.

TABLE 5.11: PREFERRED FORAGE SPECIES DISTRIBUTION - MOUNTAIN GOAT

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W	Athyrium spp. (lady ferns)										R		0	0			0			C	0		0		0	0		R	
W	Cornus sericea (red-osier dogwood)										R								0		C	0	0		R			C	R
W	Festuca spp. (fescue grasses)	C	C	R				0																					
W	Salix spp. (willows)					R	R	0		C		R	R	R	0	0				0	0							C	0
	Moderate Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	0		C			C	0	R			C	C	0		
W	Amelanchier alnifolia (common Saskatoon)																				0	C			R	R	0	0	
W	Betula papyrifera (common paper birch)																R			0	C	0			R	0	R	0	
W S	Carex spp. (sedges)			0	C	0	0		0							0		C					C	0					C
W	Juniperus communis (common juniper)							C	0		R				0											0			
W	Lonicera involucrata (twinberry honeysuckle)													C	C	R	C		0	0	C	0	0		0	R	R	0	
W	Luzula spp. (wood-rushes)	C	C	C	C	0		0			R																		
W	Pseudotsuga menziesii (Rocky Mountain Douglas-fir)																			R	R	0			R		C		
W S	Poa spp. (blue grasses)	C	0																										
W	Viburnum edule (high bush cranberry)														0					0	C	C			0	0	0	0	R
	Low Importance																												
S	Arnica spp. (arnicas)				0	0		0	0		C	R	C	0	0													R	
W	Betula glandulosa (bog glandular birch)														R	C							C						C
W	Menziesia ferruginea (Pacific menziesia)								0	C	0	C	R	0			R				R	R	0		0	0	0	0	
S	Pedicularis spp. (louseworts)		C		R	C	0	0	0		0			R	R						R								
W	Rosa spp. (roses)							0							0				C	R	C	C	0		R			C	
W	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		0	0	R	R			C	C	0	0	

[1] W = winter and early spring, S = summer and fall

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TABLE 5.12: PREFERRED FORAGE SPECIES DISTRIBUTION - MOUNTAIN CARIBOU

SEASON[1]	SPECIES (COMMON NAME)	SPECIES OCCURRENCE[2] FOR VEGETATION TYPES																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	High Importance																												
W S	Alectoria spp. (arboreal alectoria lichens)	present only in forested types - no data on occurrence																											
W	Carex spp. (sedges)			O	C	O	O		O							O		C					C	O					
W	Cetraria spp. (arboreal cetraria lichens)	present only in forested types - no data on occurrence																											
	Moderate Importance																												
W	Abies lasiocarpa (alpine fir)									C	C	C	C	C	O		C			C	O	R			C	C	O		
W	Betula glandulosa (bog glandular birch)														R	C							C						C
W	Betula papyrifera (common paper birch)																R			O	C	O			R	O	R	O	
W	Cornus sericea (red-osier dogwood)										R								O		C	O	O		R			C	R
W S	Festuca spp. (fescue grasses)	C	C	R				O																					
W	Rubus pedatus (five-leaved creeping raspberry)				R				O		C	C	C	C	C		C			C	O				C	C	O		
W	Salix spp. (willows)					R	R	O		C		R	R	R	O	O				O	O							C	O
	Low Importance																												
W	Amelanchier alnifolia (common Saskatoon)																				O	C			R	R	O	O	
W	Cornus canadensis (Canadian bunchberry)							O	O	C	R	C	C	C	C		C		C	C	C	C	O		C	C	O	C	R
W S	Equisetum spp. (horsetails)					O	O	O	O		O	O	C	C	C	O	C			O	C		O		R	R		R	
W S	Luzula spp. (wood-rushes)	C	C	C	C	O		O			R																		
W	Menziesia ferruginea (Pacific menziesia)								O	C	O	C	R	O			R				R	R	O		O	O	O	O	
W S	Vaccinium spp. (huckleberries/blueberries)				R				C	C	C	C	C	C	R		C		O	O	R	R			C	C	O	O	

[1] W = winter and early spring, S = summer and fall

[2] R = rarely, O = occasionally, C = constantly. See text for definitions.

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APPENDIX A
GLOSSARY OF TECHNICAL TERMS

associated species - Species which occur in 40 to 60% of the releves used to describe the vegetation type. They are species which will commonly, though not always, be found in areas belonging to the type.

cirque attack - A glacial erosional process leading to the creation of deep, steep-walled recesses in a mountainside (a cirque).

climax vegetation - Plant communities with a relatively stable species composition which have reached a relatively stable equilibrium with their environment and are thus self perpetuating. Two categories of Climax Vegetation are referred to, these are:

a) climatic climax (zonal) - characterize climax plant communities which reflect the climate of an area. Typically they occur on sites having mesic moisture regimes.

b) edaphic climax - climax plant communities whose vegetation composition and structure is controlled more by edaphic (soil) factors such as shallow soils, very rapidly drained soils or very poorly drained soils, than by prevailing climate.

colluvial deposits (colluvium) - Surficial materials which have reached their present position through downslope, gravity-induced movement. A product of mass-wasting commonly occurring as an accumulation at the base of steep slopes.

cryoturbation - A process common in alpine environments by which soil materials are disturbed and churned through frost action.

constant species - A species which occurs in most of the releves (plots) (>60%) used to describe the vegetation type. These species are expected to be present in most areas belonging to the particular vegetation type.

dominant species - Species which have characteristically high cover in a vegetation type.

esker - A sinuous low ridge composed of sand and gravel formed by deposition from meltwater running through a channel beneath or within glacial ice.

fluvial deposits - Materials which have originated through transportation and deposition by streams and rivers.

glacial drift - Material transported by a glacier and deposited by or from the ice or in water derived from the melting ice. Includes Glaciofluvial and Morainal materials.

glacio-fluvial deposits (glacial outwash) - Material deposited by glacial meltwaters in front of or in contact with glacier ice.

glacial till (moraine) - Material which has originated through transportation beneath, beside, on, within or in front of a glacier, and which was deposited directly by the glacier without modification by an intermediate agent (such as stream, wind wave action).

APPENDIX A (CONTINUED)

krummholz - An area of interrupted cover of subalpine tree species which are stunted to various degrees. Trees often occur in clumps interspersed with alpine tundra-like openings or other herb or shrub dominated vegetation.

lacustrine deposits - Materials which accumulated either i) by settling from suspension in bodies of standing fresh water or ii) through wave action at the margins of such water bodies.

meltwater channels - Stream channels produced in glacio-fluvial materials by glacial meltwaters.

moisture regime (hygrotope) - Moisture regime signifies moisture availability for plant growth within the context of the macroclimatic conditions represented by a Biophysical Forest Region. Assuming that within a given forest zone or subzone climatic variables such as temperature and precipitation vary within narrow ranges, the variation of available moisture results from redistribution of precipitation by edaphic factors. Explanation of the categories and assessment of moisture regime may be found in Walmsley et al. (1980).

nivation - Frost action processes and other forms of mass wasting which characteristically occur beneath a snowpack.

organic deposits - Materials resulting from the growth, decay and accumulation of vegetation material either in and around closed basins or on gentle slopes. The rate of accumulation of vegetative material exceeds the rate of decomposition resulting in peat formation.

parent material - The unaltered or essentially unaltered mineral and/or organic material within which a soil develops through the operation of soil forming processes.

physiognomy - The structure in terms of appearance of layers of vegetation without specifying the species composition of the vegetation (eg. grassland, coniferous forest, tundra).

physiograhic region - A tract of land of similar geological structure and climate which has experienced a unified physical (geomorphological) history.

pleistocene epoch - The earlier of the two epochs which constitute the Quaternary Period. The Pleistocene Epoch corresponds generally with the period of repeated glaciations which have occurred during the last few million years.

releve - A vegetation sample site which is a representative area for which the composition and structure of the plant community was recorded. The actual area of a releve varies depending on the variability of the vegetation.

seral vegetation - The continuously changing vegetation which precedes the stable climax vegetation is referred to as Seral Vegetation. Succession is considered here only in the context of secondary succession. Plant species which are not found in the climax stands are referred to as seral species. The four categories of Seral Vegetation are:

APPENDIX A (CONTINUED)

a) pioneer seral - this stage occurs following severe disturbances which have eliminated the plant population, much of the humus and litter accumulations and seed and bud banks present on the site leading to a relatively distinct vegetation "pioneering" the site.

b) young seral - seral stands or communities (other than pioneering communities or communities dominated by climax species) which are younger than sixty years old.

c) maturing seral - seral stands between sixty and one hundred and fifty years old. Generally the seral species dominate the overstory while climax species may be common in the understory.

d) overmature seral - stands dominated by seral species which are usually over one hundred and fifty years old. These stands have reached the stage where the dominant seral species are dying off and the main canopy is breaking up making room for members of the next generation.

shade tolerance - The ability of a plant, usually a tree species, to grow satisfactorily in the shade of and in competition with others. A shade tolerant tree species is one which is able to grow satisfactorily in the shade of other trees.

soil association - A group of soils that occur associated in the landscape. Its definition is based on similarities in climatic or physiographic factors, soil parent materials and vegetation zonation. The Soil Association Components which comprise a Soil Association are differentiated on the basis of relief, drainage, texture and other characteristics.

solifluction - The process of soil flowage whereby masses of unconsolidated materials which are saturated with water move downslope under the influence of gravity.

vegetation type - All plant communities similar with regard to floristic characteristics and derived from the classification of vegetation releves.

APPENDIX B
VEGETATION DATA

Maps and COENOS 1 Vegetation Data Output for the Southeast Extension Study Area are available through the Vegetation Sensitivity Unit, Waste Management Branch, British Columbia Ministry of Environment.

A species list of the vascular plants of the Southeast Extension are presented in Northeast Coal Study Area 1977-1978: A List of Vascular Plant Species. RAB Bulletin 11. Resource Analysis Branch, British Columbia Ministry of Environment, Victoria, British Columbia.

Table B.1 provides a summary of the distribution of all major and constant species in the twenty-eight vegetation types. Numbers indicate presence within each type as the percent of plots in the type in which the species occurs. Underlined values indicate which species are constant in each vegetation type.

TABLE B.1: SUMMARY CONSTANCY TABLE OF THE MAJOR AND CONSTANT SPECIES FOR EACH OF THE VEGETATION TYPES[1]

SPECIES	VEGETATION TYPE																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Layer 3 (Tree)																												
Abie las									100	100	100	83	57	20		100			69	40	13			76	83	40		
Pice eng										77	44	67	86	40		33												
Pinu con														20				100	6		50	75				30	25	9
Betu pap																17			50	67	38			5	22	10	50	
Popu tre																			3	33	50					10	50	
Pice gla											11			70		17			88	73	63	25		82	72	70	13	
Tsug het											11													66	56	80		
Thuj pli																			38					58	50	70		
Pseu men																			19	7	38			3		90		
Layer 7 (Low Shrub)																												
Shep can							80							60						7	100					10	50	
Juni com							60	25		5				20							25							
Spir bet									100								50	6	27		88			3	6	10	75	
Amel aln																				40	75			5	17	30	38	
Sali sit						10								10						40	25					10	63	9
Rosa aci							20							40				100	19	73	88	25		5			75	
Corn ser										5								50		80	25	25		8			63	9
Loni inv													57	90	11	67		50	38	93	75	25		34	17	10	38	9
Vibu edu														20					38	80	63			37	22	40	38	9
Rubu par													29			50			56	67	75			42	6		63	
Vacc mem				8				88	100	95	100	83	43	10		33			31	7	13			61	78	50	38	
Vacc ova								38		36	56	67	57			67		50	19					58	67	10		

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[1] Some character species listed in the Vegetation Type Descriptions are not included in this table due to their deletion in output from COENOS 1. Such species were restricted to one or a few vegetation types representing a very small proportion of the total number of sample plots.

TABLE B.1: (CONTINUED)

SPECIES	VEGETATION TYPE																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Oplo horr																67			69	40				97		10		
Ribe lac					10					18	11	33	57	60		100			69	60	13	25		71	33	20	13	
Menz fer								25	100	23	67	17	43			17				7	13	25		50	28	30	38	
Rhod alb								25		82	100					17												
Sali ped															56		100					25	50					18
Betu gla														10	56							75						73
Ledu gro			14				40			5		17		10				100			25	100						55
Sali x					10	20	20		100		11	17	14	30	22												13	27
Layer B (Herb)																												
Sali ret	86	100		8																								
Vacc oxy															22							75						55
Kalm mic			14			40																25						45
Vacc vit	14	14	14				20	13										100			13	50				10		36
Cast min					20		60			5				30													25	
Frag vir							60			5				60						7	50			3			38	
Aste sub							20							10	22					13	63	25					75	
Plat orb																					63			5	17	10	38	
Chim umb										5									5		88			11	33	80	50	
Pyro chl										5		17		10					6	20	13			5	11	60	38	
Maia can																			44	53	100			11	6	50	13	
Oryz asp																			13	20	100					20	38	
Lyco obs									100										19	13	38			3	6	10		
Equi arv					20	30	20	25		23	22	67	71	66	44	83			31	60		25		13	17		13	
Epil ang					50		40			23	33	67	43	80	22	67		100	13	33	50			5			50	
Cala can					20	10	20	13		5		50	29	70	33	50		50		33	13	25	50	3			13	18

[1] Some character species listed in the Vegetation Type Descriptions are not included in this table due to their deletion in output from COENOS 1. Such species were restricted to one or a few vegetation types representing a very small proportion of the total number of sample plots.

TABLE B.1: (CONTINUED)

SPECIES	VEGETATION TYPE																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Gali trf					20								14			33			25	67	13			11			13	
Osmo chi										36			29	40		17			19	60	25			11		10	75	
Aste con														40					13	53	38			3			50	
Pyro asa							20						29	10	22				25	47		50		21	22	10	13	18
Mite nud					10					9		17	14	30					44	67		25		39	11	40	25	9
Rubu pub							20						14	50		17			63	87	25	25		16			38	
Aral nud																			75	60	63			55	44	30	50	
Clin uni										5	11		14			33			50	40	38			79	61	40	38	
Smil rac												17	14			67			56	67	13			66	39	60	50	
Corn can							40	25	100	18	56	67	57	100		100		100	88	67	88	25		97	100	50	63	18
Orth sec										32	22	33	57	80					31	47	75			74	89	70	63	9
Linn bor							40						29	70				100	44	33	100	25		24	61	40	63	9
Dryo ass								25		23	44	67	43			67			44	13				61	39	10		
Lyco ann								13		41	56	50	57			17		56	38	27	38			53	44			
Rubu ped				8				50		86	89	100	86	60		100			56	20				89	94	20		
Stre amp					10					32	11	33	57	10		50			44	40		25		61	28	10	13	9
Tiar uni								13		77	44	33	43	10		67			81	33				87	83	20		
Stre ros								13		59	44	50	29			83			81	67	25			89	67	40		
Gymn dry					10			13		41	67	33	43			100			100	73	25			92	89		25	
Athy fil										5		33	29			50			69	40		25		42	28		13	
Tiar tri											22	33	29			67			19	7				42	17	10		
Equi syl											22	50		10		50			38	27		25		29	39		13	
Viola					30	10			100	5	11			10		17			6		13			5	6	10	13	
List cor								13		77	56	33	57	20		17			6		13			45	61	10	13	18
Mone uni										9	11	33	29	20						7	13			45	39	50		
Good obl																		50	13	13	56			47	39	50	63	
Poa arc	86	29						13																				
Luzu arc	57	71	57																									

[1] Some character species listed in the Vegetation Type Descriptions are not included in this table due to their deletion in output from COENOS 1. Such species were restricted to one or a few vegetation types representing a very small proportion of the total number of sample plots.

TABLE B.1: (CONTINUED)

SPECIES	VEGETATION TYPE																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Sile aca	71	86	29																									
Fest bra	71	57	14				20																					
Luzu spi	57	71	29				20																					
Bist viv	71	71		17	20	50	40																					
Tris spi	57	57	14	8																								
Gent gla	71	43	71	25			20																	3				
Sibb pro	14	57	43	33	30			38																				
Arte arc	71	86	43	17	60	30	20	50		5																		
Phyl gla	14		71	8				38																				
Empe nig	14	14	29				20	38		5		17		20				100										
Phle alp	14	29		17	50	10																						
Vero wor		14		17	50	30									11													
Care spe			29	25	50	20		38		5																		
Lyco alp	14	14	57	25	10			25		14				10														
Hier gra	14		57	67	30			25		23		17																
Epil obi				58	40					14			14		11													9
Care nig	14		14	100		30				9																		
Luzu pip		14	14	67	20		20			5																		
Phyl emp				50	20	10		50	100	23	33	17															13	
Cass mer			57	58		20		63	23	11	17													3				
Vahl atr			29	83	20	40		25		73	11	50	14	10														
Arni lat				50	40		20	25		82	11	83	29	20													13	
Vale sit				17	90	10		13		86	22	67	43	10		50			6	7				5				
Vera vir				17	90	10		13		82	22	17	57			50			19	13				24	11			9
Acon del	14				70	20				23			14							13								
Erig per				25	60	40	20	13		32		17		10														
Pedi bra				17	70	30	20	25		41			14	10						7								
Trol lax				8	50	40				32		17																

[1] Some character species listed in the Vegetation Type Descriptions are not included in this table due to their deletion in output from COENOS 1. Such species were restricted to one or a few vegetation types representing a very small proportion of the total number of sample plots.

TABLE B.1: (CONTINUED)

SPECIES	VEGETATION TYPE																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Sene tri				42	70	30				32			14		22													9
Parn fim						10	70	60		27		17	14															
Calt lep					33		70			14																		
Care aqu						30									78		100											
Tofi glu						60	40								11							25						45
Plat dil					10	30	20							10	44					7		50		3				18
Care sit						10									22		100					50	50					55
Care pau															33							75						64
Meny tri															11							75						45
Andr pol															11							50						55
Layer 9 (Mosses)																												
Poly pil	57	57	43	17				25		5	11																	
Palu squ						50									33													9
Pleu sch						10		25	100	45	89	83	71	70		100		100	75	53	88	75		92	100	80	50	27
Ptil cri								25	100	14	56	50	43	60		83		50	69	33	25	50		89	89	80	38	9
Rhyt rob									100	32	22		14										3					
Dicr pal			14	42				38	100	55	44	17		10		17										10		
Hylo spl						10	40	13		9	33	33	43	70				50	56	20	38			71	100	100		
Rhyt tri							20					17	29	50					50	60	50			63	50	80	63	
Rhyt squ					10	10				18	11	17	14	10	11	50			6	7				5				9
Brac hyt										32			43	10			100		13	27	13			5	6			9
Dicr sco					10			13													50					10	38	
Plag dru												17		20		33			56	20		25		29	17		13	
Spha nem						10									33							75						64

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[1] Some character species listed in the Vegetation Type Descriptions are not included in this table due to their deletion in output from COENOS 1. Such species were restricted to one or a few vegetation types representing a very small proportion of the total number of sample plots.

APPENDIX C

SOILS AND ENVIRONMENT INFORMATION FOR EACH VEGETATION TYPE

The information listed in the following tables is taken directly from the vegetation and soils survey field forms which were completed during the 1977 field season. The authors are not responsible for inaccuracies in this data.

Throughout these tables the following applies: landform symbols conform with ELUC Secretariat (1976). The Soil Association components listed are described in Maxwell (1982). Due to the complexity of the landscapes, the associated field parameters may not always fall within the stated limits for the soil association or its component. The soil pH is generally obtained from soil samples taken from the upper 30 cm of the soil profile. Calcareousness is determined from the C horizon. Missing data are indicated by hyphens (-).

TABLE C.1: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 1

Type 1	Net-leaved dwarf willow - entire-leaved white mountain-avens (white mountain-avens)													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770136	RMH10	1829	17	226	upper slope	subxeric	mod. well	rCv/R	sandstone shale	RR 11	TU.R	sl	7.0	m
770150	RMH21	2012	12	160	upper slope	submesic	-	rfCbv	shale & sandstone	RR 2	TU.R	sl	4.8	w
770071	TOH6	1981	6	100	upper slope	submesic	well	gfCb	shale & sandstone	RR 2	TU.MB	l	-	w
770152	RMH23	1905	1	196	upper slope	submesic	mod. well	Mb	sandstone	RR 1	O.SB	l	4.7	non
770105	-	2024	26	212	upper slope	submesic	well	Cv	schist	TE 1	L.SDYB	sil	-	non
770106	-	2078	16	125	-	submesic	-	Cb	schist	TE 1	L.DYSB	sil	-	-
770124	-	2091	0	level	apex	xeric	well	R	schist	TE 1	CRLTU.B	s	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.2: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 2

Type 2	Net-leaved dwarf willow - moss campion - boreal mugwort													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL[1] (C horizon)
770125	-	2160	8	160	apex	subxeric	mod. well	R	schist & sandstone	TE 1	L.R	s	-	non
770148	RMH21	2010	5	70	upper slope	submesic	mod. well	rfCbv	shale	RR 11	TU.R	-	4.8	w
770084	TOH12	1890	-	-	face	submesic	well	gCv/Mv	quartzite shale	GM 4	O.R	sl	4.0	w
770073	TOH6	1980	6	100	upper slope	mesic	mod. well	gfCb	-	RR 2	TU.MD	l	-	-
770187	ACH28	1910	5	230	upper slope	subxeric	well to mod. well	RCv(rf)	-	MN 4	TU. or O.DYB	cl	-	-
770149	RMH21	2010	22	218	upper slope	submesic	well	rfCbv	limefree sandstone	RR 2	TU.R	-	4.8	non
770098	ACH7	1920	0	level	apex	subxeric	well	Cv	quartzite	MN 3	LTU.R	s	4.0	-

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.3: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 3

Type 3	Mertens' cassiope - cream mountain-heather - Cetraria spp.													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770108	-	1730	2	70	apex	submesic	well	Cv	schist & quartzite	TE 2	O.DYB	sil	-	non
770112	-	2110	11	100	upper slope	submesic	mod. well	Cv/R	-	TE 4	TU.R	-	-	non
770126	-	1990	11	30	upper slope	subhygric	imper.	Cv	sandstone & schist	TE 2	TU.R	sl	-	non
770107	-	2060	15	198	apex	submesic	well	Cb	schist	TE 2	L.DYSB (O.HFP)	sil	-	non
770154	RMH24	1850	3	160	upper slope	subxeric	well	sgF^{G}h	quartzite	MN 4	O.HFP	s	3.7	non
770140	RMH16	1830	2	150	upper slope	mesic	mod. well	rsCb=Mb	quartzite	MN 2	O.HFP	s	-	non
770141	RMH17	1860	0	level	upper slope	submesic	well	ƒrMm	quartzite	MN 1	O.R.	s	3.3	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.4: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 4

Type 4	Mertens' cassiope - black alpine sedge - Barbilophozia floerkei													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770155	RMH24	1870	11	172	upper slope	xeric	well	sgF^{G}h	quartzite	MN 4	O.HFP	s	3.7	non
770110	-	1940	20	10	middle slope	mesic	mod. well	Mv	-	TE 2	O.HFP	sl	-	non
770130	-	1900	15	280	upper slope	mesic	mod. well	Cb	schist	TE 1	O.HFP	l	-	non
770114	-	1970	17	138	lower slope	subhygric	well	C	-	TE 4	O.HFP	ls	-	non
770075	TOH8	1540	1-3	320	upper slope	mesic	mod. well	gfMb	quartzite & gneiss	DO 3	PZ.GL	scl	3.8	non
770111	-	1960	7	226	upper slope	submesic	-	Mv (or Mb)	-	TE 1	O.HFP	ls	-	non
770099	ACH8	1770	7	330	upper slope	mesic	well	gsMbv	quartzite	MN 2	TU.DYB or E.DYB	s	3.8	non
770083	TOH12	1860	8	290	apex	hygric	-	rfCv	quartzite, shale, dolomite	GM 3	SM.HFP	cl	4.0	non
770113	-	1930	2	320	lower slope	hygric	imper. to poorly	Mb	-	TE 4	.HG	s	-	non
770072	TOH6	1980	6	100	upper slope	subhygric	mod. well	gfCb	sandstone & shale	RR 11	TU.SMB	l	-	non
770115	-	2070	20	100	lower slope	subhygric	poorly	C	-	TE 4	GL.R	-	-	non
770076	TOH8	1540	3	280	middle slope	hygric	imper.	gfMb	quartzite & gneiss	GM 4	PZ.GL	c	3.8	non

Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770155	RMH24	1870	11	172	upper slope	xeric	well	sgF^{G}h	quartzite	MN 4	O.HFP	s	3.7	non

Plot Number	Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Association Component	Soil Development	Soil Texture	$(CaCl_2)$ (0-30 cm)	(C horizon)
770155	RHH24	1870	11	172	upper slope	xeric	well	sgr^{G}h	quartzite	MH 4	O.HFP	s	3.7	non
770110	-	1940	20	10	middle slope	mesic	mod. well	Mv	-	TE 2	O.HFP	sl	-	non
770130	-	1900	15	280	upper slope	mesic	mod. well	Cb	schist	TE 1	O.HFP	l	-	non
770114	-	1970	17	138	lower slope	subhygric	well	C	-	TE 4	O.HFP	ls	-	non
770075	TOH8	1540	1-3	320	upper slope	mesic	mod. well	gfMb	quartzite & gneiss	DO 3	PZ.GL	scl	3.8	non
770111	-	1960	7	226	upper slope	submesic	-	Mv (or Mb)	-	TE 1	O.HFP	ls	-	non
770099	ACH8	1770	7	330	upper slope	mesic	well	gsMbv	quartzite	MH 2	TU.DYB or E.DYB	s	3.8	non
770083	TOH12	1860	8	290	apex	hygric	-	rfCv	quartzite, shale, dolomite	GM 3	SM.HFP	cl	4.0	non
770113	-	1930	2	320	lower slope	hygric	imper. to poorly	Mb	-	TE 4	.HG	s	-	non
770072	TOH6	1980	6	100	upper slope	subhygric	mod. well	gfCb	sandstone & shale	RR 11	TU.SMB	l	-	non
770115	-	2070	20	100	lower slope	subhygric	poorly	C	-	TE 4	GL.R	-	-	non
770076	TOH8	1540	3	280	middle slope	hygric	imper.	gfMb	quartzite & gneiss	GM 4	PZ.GL	c	3.8	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.5: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 5

Type 5	Sitka valerian - showy sedge - green false hellebore													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770116	-	1820	9	150	upper slope	mesic	well	Cv	-	TE 4	0.HFP	sil	-	non
770085	TOH13	1600	2	-	lower slope	mesic	mod. well	$\mathrm{bsF^{G}b}$	quartzite	PK6 (or HP6)	0.HFP	l	3.9	non
770052	PMH1	1430	9	230	upper slope	submesic	well	bfMb	quartzite, limestone, phyllite, sandstone	BB 4	0.HFP	sicl	4.4	non
770092	ACHL	1630	15	90	lower slope	mesic	mod. well	gfMbv	sandstone, quartzite, limestone	PK 1	0.HFP	l	4.2	non
770091	ACHL	1640	10	90	upper slope	submesic	well	gfMbv	sandstone, quartzite, limestone	PK 1	0.HFP	medium	4.2	non
770077	TOH9	1190	15	120	lower slope	subhygric	well	rfCb	schist	DZ 11	SM.HFP	sl	5.0	w
770078	TOH9	1190	15	120	lower slope	subhygric	well	rfCb	schist	DZ 11	SM.FHP	sl	5.0	w
770053	PMH1	1430	9	230	upper slope	subxeric	well	bfMb	quartzite	BB 1	0.HFP	sil	4.4	non
76-1111	-	1730	6	194	upper slope	mesic	rapidly	C	shale	-	0.DYB	sil	-	non
76-1115	-	1530	18	210	lower slope	mesic	well	C	shale	-	0.EB	sil	-	s

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.6: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 6

Type 6	Willow spp. - sedge spp. - white marsh-marigold - tufted deer-grass													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770090	ACH3	1460	0	level	upper slope	subhydric	poorly	O	-	HA 4	TY.F	fibric	4.4	non
770057	PMH2	1360	3	40	lower slope	subhygric	-	gfCv/Mv	-	HK 8	.G	-	4.5	-
770054	PMH2	1360	0	level	lower slope	hygric	imper.	Ov/Fv	-	HK 8	FI.G	fibric	4.5	non
770143	RMH18	1660	9	120	middle slope	subhygric	-	sFf/Cb	quartzite	HP 7	O.HFP	sl	5.2	non
770064	TOH2A	1370	3	30	middle slope	hygric	imper.	Ob	-	HA 4	.M	mesic	-	-
770055	PMH2	1360	2	40	lower slope	hygric	imper.	Ov/F	-	HK 8	FI.G	fibric	4.5	non
770144	RMH18A	1630	3	40	lower slope	subhygric	imper.	sFb	quartzite	HP 7	FI.G	s	-	non
770190	ACH31	1510	0	level	valley floor	hygric	poorly	sFl	-	KN 8	GL.R	s	-	w
770068	TOH4	1460	0	level	lower slope	sybhygric	poorly	gfMv/R	-	NK 8	GLBR.GL	-	-	non
770153	RMH23	1900	3	120	upper slope	mesic	mod. well	Mb	sandstone	RR 1	O.SB	sl	4.7	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.7: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 7

Type 7	Engelmann spruce - common juniper - goldenrod spp.													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770137	RMH11	1810	20	180	upper slope	submesic	well	frCb	shale & sandstone	RR 3	0.SB	-	5.1	w
770081	TOH11D	1140	5	30	middle slope	subxeric	well	frFf	-	PX 10	.R	s	-	w
770080	TOH11D	1140	5	30	middle slope	subxeric	well	frFf	-	PX 10	.R	s	-	w
770058	RMH1	1370	16½	110	middle slope	mesic	imper.	gcMb	limestone	HO 7	GLBR.GL	c	6.7	w
76-1112	-	1130	3	246	valley floor	submesic	well	F	-	-	0.R	s	-	w

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.8: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 8

Type 8	Alpine fir - black blueberry - red mountain-heather - Mertens' cassiope													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770169	-	1580	4	180	upper slope	mesic	well	Mb	-	SM 3	-	-	-	non
770051	MRH1	1280	22	310	lower slope	mesic	imper.	ℓFv^{A}/$_{gFt}$	-	DC 11	GL.R	sil	-	non
770142	RMH17	1840	23	128	upper slope	submesic	well	srMm (Cb)	quartzite	MN 1/MN 2	O.R	s	3.3	non
770156	RMH24A	1890	20	170	upper slope	submesic	well	sgF^{G}h	quartzite	MN 2	D.DYB	s	3.6	non
770060	RMH3	1650	9	360	upper slope	submesic	well	arF^{G}b	quartzite	HP 3	-	s	3.7	-
770138	RMH12	1770	20	340	upper slope	mesic	-	rfCv	sandstone & shale	HS 3	D.EB	l	4.9	non
770131	-	1870	15	230	upper slope	subxeric	mod. well	Cb	-	HL 3	TUO.HFP	s or l	-	non
770109	-	1700	23	150	upper slope	xeric	well	Cv/R	schist	HL 3	LSM.HFP	-	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.9: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 9

Type 9	Lodgepole pine - Pacific menziesia - red mountain-heather												
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH $(CaCl_2)$ (0-30 cm)	CAL.[1] (C horizon)
770133	-	1540	26	202	middle slope	subxeric	well	$Cb/F^{G}t$	schist	HL 2	O.HFP	s	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.10: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 10

Type 10	Alpine fir - black blueberry - white-flowered rhododendron - Sitka valerian - broad-leaved arnica													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH $(CaCl_2)$ (0-30 cm)	CAL.[1] (C horizon)
770067	TOH4A	1460	3	130	middle slope	submesic	imper.	Mv	-	HK 5	BR.GL	sicl	-	non
770097	ACH6	1630	0	level	upper slope	submesic	well	gfF^6v	quartzite sandstone	HP 5	O.HFP	s	3.9	non
770207	ACH46	1840	12	240	upper slope	submesic	mod. well	fMb	-	SM 3	PZ.GL	cl	-	-
770127	-	1860	10	20	upper slope	submesic	mod. well	Cb	schist, quartzite	DZ 3	O.FHP	sil	-	non
770196	ACH35	1710	6	17	upper slope	subhygric	mod. well	gfMb	schist, quartzite	BS 4	BR.GL	l	-	-
770204	ACH43	1750	23	215	upper slope	submesic	mod. well	rfCbv	phyllite, schist	SM 3	LU.HFP or O.HFP	-	-	-
770166	ACH13	1630	4	80	upper slope	mesic	mod. well	gfMb	quartzite, sandstone, shale	SM 3	O.HFP	sl	4.2	non
770185	ACH26	1580	17	360	upper slope	subhygric	imper.	gfMb(v)	-	BS 7	BR.GL	cl	-	non
770117	-	1630	25	148	upper slope	mesic	well	Cb	-	DZ 11	O.HFP	s	-	non
770089	ACH3	1460	14	80	lower slope	subhygric	imper.	frCbv	quartzite	BB 5	O.HFP	l	4.4	non
770191	ACH32	1540	14	140	upper slope	submesic	well	gsMb	quartzite, sandstone	BB 1	O.EB	l	-	-
770203	ACH42	1520	15	330	middle slope	subhygric	mod. well	rfCv/gfMb	shale, quartzite	SM 3	PZ.GL	cl	-	-
770059	RMH2	1370	13	20	middle slope	submesic	well	Cbv	quartzite	HS 5	O.EB	cl	5.1	-
770056	PMH2	1360	11	40	middle to lower slope	mesic	mod. well	gfCv/Mv	-	HK 6	L.HFP	sl	4.5	non
770192	ACH33	1510	11	255	lower slope	mesic	mod. well	gfMb	limestone, quartzite	BS 4	BR.GL	cl	-	-

770127	-	1860	10	20	upper slope	submesic	mod. well	Cb	schist, quartzite	DZ 3	O.FHP	sil	-	non
770196	ACH35	1710	6	17	upper slope	subhygric	mod. well	gfMb	schist, quartzite	BS 4	BR.GL	l	-	-
770204	ACH43	1750	23	215	upper slope	submesic	mod. well	rfCbv	phyllite, schist	SM 3	LU.HFP or O.HFP	-	-	-
770166	ACH13	1630	4	80	upper slope	mesic	mod. well	gfMb	quartzite, sandstone, shale	SM 3	O.HFP	sl	4.2	non
770185	ACH26	1580	17	360	upper slope	subhygric	imper.	gfMb(v)	-	BS 7	BR.GL	cl	-	non
770117	-	1630	25	148	upper slope	mesic	well	Cb	-	DZ 11	O.HFP	s	-	non
770089	ACH3	1460	14	80	lower slope	subhygric	imper.	frCbv	quartzite	BB 5	O.HFP	l	4.4	non
770191	ACH32	1540	14	140	upper slope	submesic	well	gsMb	quartzite, sandstone	BB 1	O.EB	l	-	-
770203	ACH42	1520	15	330	middle slope	subhygric	mod. well	rfCv/gfMb	shale, quartzite	SM 3	PZ.GL	cl	-	-
770059	RMH2	1370	13	20	middle slope	submesic	well	Cbv	quartzite	HS 5	O.EB	cl	5.1	-
770056	PMH2	1360	11	40	middle to lower slope	mesic	mod. well	gfCv/Mv	-	HK 6	L.HFP	sl	4.5	non
770192	ACH33	1510	11	255	lower slope	mesic	mod. well	gfMb	limestone, quartzite	BS 4	BR.GL	cl	-	-
770128	-	1720	10	20	upper slope	mesic	mod. well	Cb	schist, quartzite	DZ 3	-	sicl	-	non
770188	ACH29	1660	11	125	upper slope	mesic	mod. well	gfMb(v)	quartzite, limestone	BS 3	O.HFP or PZ.GL	sl	-	w
770198	ACH37	1580	17	140	upper slope	mesic	mod. well	pfMb	-	SM 3	O.HFP or LU.HFP	l	-	non
770186	ACH27	1600	16	200	upper slope	mesic	well	Cv(b)	quartzite	BB 1	O.HFP	-	-	non
770118	-	1490	18	150	upper slope	subhygric	-	Cb	-	DZ 5	-	ls	-	non
76-1153	-	1710	11	190	upper slope	subhygric	-	M	-	-	.HFP	sil	-	non
76-1156	-	1520	26	32	upper slope	hygric	imper.	Fl/R	-	-	.R	sil	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.11: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 11

Type 11	Alpine fir - white-flowered rhododendron - oak fern - five-leaved creeping raspberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770093	ACH4	1080	0	level	valley floor	subhygric	imper.	ℓLb	-	DC 2	PZ.GL	sl	3.6	non
770063	TOH2	1370	6	30	middle slope	mesic	mod. well	ℓLb	-	DC 1	O.FHP	sil	-	non
770095	ACH5	1100	8	275	lower slope	mesic	well	fgFt	quartzite, sandstone	OV 1	O.HFP	s	4.2	m
770129	-	1450	25	360	middle slope	mesic	well	F^G or Cb	-	DZ 1	O.HFP	sl	-	non
770193	ACH34	1390	20	180	middle slope	mesic	well	gsFb or Mb	-	BB 1	O.HFP	ls	-	-
770205	ACH44	1280	1	210	valley floor	mesic	mod. well	sgFt	schist	FG 1	O.HFP	ls	-	-
770202	ACH41	1500	20	210	upper slope	submesic	well	gs-gf Mbv	quartzite	HL 3	O.HFP	sl	-	-
770065	TOH3	1480	3-6	150	upper slope	submesic	mod. well	gfMbv	quartzite, sandstone	NK 4	L.HFP	sicl	-	non
770132	-	1710	23	212	middle slope	subxeric	well	Cb	schist	HL 2	BR.GL	scl	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.12: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 12

Type 12	Mertens' cassiope - cream mountain-heather - Cetraria spp.													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770157	RMH25	1140	5	240	upper slope	mesic	well	s̸lLb	-	DC 7	LU.P	sicl	3.6	non
770087	ACH2	1110	0	level	lower slope	subhygric	imper.	s̸Lt	-	BO 7	GLPZ.L	si	4.7	non
770189	ACH30	1550	10	250	lower slope	mesic	mod. well	rfCb	limestone, sandstone	HK 4	BR.GL	cl	-	w
770145	RMH13	1540	6	70	upper slope	subhygric	imper.	gsFb	quartzite	HP 7	GL.EB	s	4.8	non
770218	-	1380	28	36	upper slope	submesic	well	Cv	-	WD 1	O.HFP	l	-	non
770066	TOH4	1460	3	130	middle slope	subhygric	imper.	gfMv/R	mudstone, quartz cobbles	NK 7	GLBR.GL	sicl	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.13: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 13

Type 13	Engelmann spruce - black swamp gooseberry - five-leaved creeping raspberry - green false hellebore													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770197	ACH36	1430	21	360	lower slope	hygric	imper.	Cv/Fb	shale, schist	DC 7/CS 4	GL.GL	ls	-	-
770082	TOH11C	1130	0-2	42	lower slope	hygric	poorly	sfFb	-	PX 10	O.G or O.HG	sil	-	w
770119	-	1430	25	160	middle slope	mesic	well	Cb	-	DZ 5	L.HFP	s	-	non
770123	-	1060	5	334	lower slope	mesic	well	Cf/Ft	-	FN 1	O.HFP	s	-	non
770206	ACH45	1240	33	30	middle slope	subhygric	-	gslMb/Cb	shale	CS 2	O.HFP	sl	-	-
76-1154	-	1130	0	level	valley floor	hygric	mod. well	Fl	-	-	.EB	ls	-	s
76-1155	-	1140	13	64	valley floor	hygric	poorly	Fl	-	-	.G	c	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.14: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 14

Type 14	White spruce - twinberry honeysuckle - Canadian bunchberry - northern twinflower													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770179	ACH21	1140	3	250	valley floor to lower slope	mesic	well	gFt	-	KN 2	CU.R	s	-	m
770180	ACH22	1220	8	340	lower slope	subhygric	well	sFt	-	OV 1	.B or .R	s	-	-
770178	ACH20	1130	1	180	lower slope	subhygric	well	sFt	-	KN 1	CU.R	s	-	w
770151	RMH22	1200	0	-	valley floor	mesic	well	(s)gFl	sandstone, quartzite, limestone	KN 1	CU.R	s	-	s
770074	TOH7	1200	3	20	middle slope	submesic	well	fgFt	-	KN 1	CU.R	sl	-	w
770050	MRH1	1220	1-3	level	lower slope	subhygric	imper.	ℓFv/gFt	-	RN 7	GL.R	sicl	-	non
770069	TOH5	1400	10	300	valley floor	mesic	well	frCb	quartzite, sandstone	HS 2	O.DYB	l	-	non
770070	TOH5A	1402	0	level	valley floor	submesic	well	fgFt	mudstone, sandstone, quartzite	HO 1	O.HFP	l	-	-
76-1113	-	1137	1	304	valley floor	mesic	well	Fl	-	-	CU.R	s	-	s
76-1114	-	1152	9	174	valley floor	mesic	well	Mb	-	-	D.DYB	c	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.15: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 15

Type 15	Bog willow - bog glandular birch - water sedge - Sphagum spp.													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770177	ACH19	1200	0	level	lower slope	hygric	poorly	-	-	OV 8	-	-	-	-
770181	ACH22	1220	0	level	lower slope	hygric	-	-	-	OV 8/HA 4	-	fibric	-	-
770096	ACH5	1100	0	level	lower slope	subhydric	poorly	Ov	-	HA 4	.F	fibric	-	-
770147	RMH20	1100	0	level	lower slope	hygric	poorly	Ov/sFt	-	(MT 1) (NE Coal Core Report '76-77)	.F	fibric	-	non
770094	ACH4	1080	0	level	valley floor	subhydric	very poorly	O	-	HA 1	TY.F	fibric	-	non
770088	ACH2A	1100	0	level	upper slope	hygric	poorly	-	-	MX 1	TY.F	fibric	-	non
770159	RMH25A	1140	1	286	lower slope	subhydric	-	Ob	-	DC 8	.M	mesic	4.0	non
770158	RMH25A	1140	3	286	valley floor	subhydric	imper.	Ob	-	DC 8	.M	-	4.0	non
76-1110	-	930	1	210	valley floor	subhydric	poorly	Fl	-	-	R.G	sc	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.16: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 16

Type 16	White spruce X Engelmann spruce - alpine fir - black swamp gooseberry - oak fern													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770079	TOH10	1040	6	190	lower slope	subhygric	mod. well	c$Lb	-	BO 1	BR.GL	c	3.9	non
770061	TOH1	930	8	330	valley floor	mesic	mod. well	$Lb	-	DC 2	GLPZ.GL	sil	-	non
770160	RMH26	1200	6	228	middle slope	mesic	well	Mbv	quartzite, dolomite, phyllite, schist	HL 1	O.HFP	s	3.7	non
770183	ACH24	1140	0-1	10	lower slope	mesic	mod. well	gsFt	-	FG 1	O.HFP	s	-	-
770086	ACH1	910	0	level	lower slope	mesic	mod. well	$Lt	-	BO 1	LU.P or O.HFP	sil	4.0	non
76-1152	-	930	5	234	valley floor	subhydric	poorly	Fl	-	-	.G	s	-	s

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.17: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 17

Type 17	Bog willow - Sitka sedge - Brachythecium sp.													
Vegetation Plot Number	**Soil Survey Number**	**Elevation (m)**	**Slope (°)**	**Aspect (°)**	**Landscape Position**	**Moisture Regime**	**Drainage**	**Landform**	**Lithology**	**Soil Association Component**	**Soil Development**	**Soil Texture**	**pH ($CaCl_2$) (0-30 cm)**	**CAL.[1] (C horizon)**
770062	TOH1	930	0	-	valley floor	hygric	imper.	fLb	-	KN 8	F1.G	-	-	-

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.18: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 18

Type 18	Lodgepole pine - velvet-leaved blueberry - Canadian bunchberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770146	RMH20	1110	7	310	lower slope	submesic	well	sFt	quartz & sandstone gravels	HO 1	D.DYB (O.HFP)	s	4.7	non
770176	ACH19	1200	6	165	middle slope	subxeric	rapidly	sgFt	-	OV 1	O.HFP	s	-	-

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.19: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 19

Type 19	White spruce - alpine fir - devil's-club - oak fern - unifoliate-leaved foamflower													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770252	-	730	0	level	lower slope	mesic	well	sgFt	-	LO 1	O.HFP	s	-	non
770250	-	750	0	level	lower slope	mesic	well	sgFt	-	LO 1	O.HFP	s	-	non
770249	-	750	0	level	lower slope	mesic	well	sgFt	-	LO 1	O.HFP	s	-	m
770171	ACH15	700	0	level	valley floor	mesic	mod. well	sgFl	-	PM 1	O.HFP	s	-	non
770032	-	660	23	82	lower slope	-	well	fsFt	-	LO 1	BR.GL	s	-	non
770034	-	660	0	level	lower slope	mesic	well	sF/gF	-	LO 1	O.HFP	s	-	non
770103	-	760	3	45	lower slope	mesic	well	gFf	-	FN 1	O.HFP	sl	-	non
770035	-	650	0	level	lower slope	mesic	-	F	-	LO 1	O.HFP	-	-	-
770028	-	650	5	134	valley floor	mesic	mod. well	Ff	-	LO 1	.BR.GL	c	-	non
770209	-	650	0	level	valley floor	submesic	mod. well	fsFt	-	LO 2	.GL	cl	-	-
770216	-	740	0	level	lower slope	mesic	-	sFt	-	LO 2	O.HFP	s	-	-
770024	-	710	0	level	lower slope	mesic	well	Ft	-	PM 1	O.HFP	s	-	non
770253	-	750	0	level	valley floor	subhygric	mod. well	Fl	-	LO 7	O. R	s	-	m
770251	-	710	0	level	valley floor	mesic	well	sFt	-	LO 1	O.HFP	s	-	non
770215	-	740	32	278	valley floor	mesic	mod. well	sgFt	-	LO 1	BR.GL	s	-	non
76-1157	-	780	0	level	valley floor	hygric	-	F	-	-	.G	ls	-	non

TABLE C.20: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 20

Type 20	White spruce - common paper birch - twinberry honeysuckle - red-osier dogwood - dwarf .red blackberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770162	ACH10	780	5	226	valley floor	mesic	rapidly	gsFf	quartzite, sandstohe, limestone, domomite	LO 2 or GF 1	O.HFP	s	6.2	w
770041	-	630	8	10	valley floor	mesic	well	sFt	-	LO 1	O.HFP	s	-	-
770164	ACH11	790	0	level	valley floor	mesic	rapidly	sFl	-	GF 1	CU.R	ls	6.9	w
770201	ACH40	640	0	level	valley floor	mesic	well	sFl	-	GF 1	CU.R	s	-	w
770030	-	650	0	level	lower slope	mesic	imper.	fsFt	-	LO 1	O.GL	sc	-	non
770027	-	760	26	342	lower slope	mesic	mod. well	L	-	RH 4	BR.GL	c	-	non
770235	-	740	0-2	174	valley floor	mesic	imper.	L	-	RH 7	GL.GL	c	-	non
770037	-	640	30	260	-	-	well	Ft	-	LO 1	O.HFP	s	-	non
770238	-	740	22	216	lower slope	mesic	mod. well	Mb	-	LZ 1	O.HFP or D.DYB	ls	-	-
770256	-	710	0	level	valley floor	subhygric	well	Fl	-	GF 1	CU.R	s	-	non
770237	-	720	0	level	valley floor	subhygric	poorly	Fl	-	GF 1	O.R	s	-	-
770175	ACH18	650	0	level	valley floor	mesic	well	sFt	-	GF 7	GL.R	s	-	w
770173	ACH17	640	0	level	valley floor	mesic	-	sFt	-	GF 7	O.EB	-	-	non
770174	ACH17	640	0	level	valley floor	mesic	well	sFt	-	GF 1	O.EB	s	-	non
770031	-	640	0	level	valley floor	mesic	well	sgFt	-	LO 1	O.HFP	s	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.21: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 21

Type 21	White spruce - lodgepole pine - soopolallie - rough-leaved rice grass - northern twinflower													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770029	-	650	35	160	lower slope	mesic	well	fsFt	-	LO 2	D.DYB	s	-	m
770236	-	760	27	226	lower slope	mesic	well	Mb	-	LO 4	-	s	-	w
770228	-	730	0	level	valley floor	submesic	well	sgFt	-	LO 1	D.DYB	s	-	non
770226	-	740	0	level	lower slope	submesic	well	sFt	-	LO 1	O.HFP	s	-	non
770229	-	750	0	level	valley floor	mesic	well	sgF^G	-	LO 1	O.HFP	s	-	non
770227	-	740	6	78	valley floor	mesic	well	gF^Gt	-	LO 2	D.DYP	s	-	non
770230	-	750	0	level	valley floor	mesic	well	sFt	-	LO 1	O.HFP	s	-	non
770019	-	720	2	90	lower slope	subxeric	well	Ft	-	PM 2	O.HFP	ls	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.22: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 22

Type 22	Lodgepole pine - common Labrador tea - bog cranberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770036	-	640	0	level	lower slope	subhydric	poorly	Ov	-	LO 8	.G (peaty phase)	mesic	-	non
770033	-	810	0	level	lower slope	subhydric	very poorly	Ov/L1	-	CC 4	TY.F	c	-	non
770038	-	760	0	level	lower slope	subhydric	very poorly	O^b	-	CC 4	TY.M	mesic	-	non
76-1116	-	790	0	level	valley floor	subhygric	very poorly	Fb	-	-	TY.M	mesic	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.23: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 23

Type 23	Hoary sedge - hemlock water-parsnip													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770042	-	610	0	level	valley floor	subhydric	very poorly	0^F/sFt	-	LO 8	.HG	s	-	non
770043	-	610	0	level	lower slope	subhydric	very poorly	0^F/sF	-	LO 8	.HG	s	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.24: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 24

Type 24	Western hemlock - western red cedar - devil's-club - black blueberry - oak fern - Canadian bunchberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770015	-	870	18	316	lower slope	mesic	mod. well	Mb	-	LZ 1	.DYB	c	-	non
770194	-	870	14	20	middle slope	subhygric	mod. well	Mb	-	LZ 1	O.HFP	cl	-	non
770195	-	900	12	50	middle slope	mesic	mod. well	Mb	-	LZ 1	PZ.GL	sicl	-	non
770044	-	800	3	38	middle slope	mesic	well	Mb	-	LZ 1	O.HFP	scl	-	non
770004	-	800	7	62	lower slope	mesic	imper.	L	-	RH 1	.GL	c	-	non
770005	-	850	3	158	lower slope	mesic	well	F^G	-	PM 1	O.HFP	s	-	non
770242	-	900	6	42	lower slope	mesic	poorly	L	-	RH 7	O.GL	c	-	non
770167	ACH14	880	35	330	lower slope	mesic	well	sFT	quartzite	FG 1	O.HFP	sl	0.43	non
770208	-	820	0-2	52	lower slope	mesic	well	sgFt	-	PM 1	O.HFP	s	-	-
770200	ACH39	820	3	230	lower slope	mesic	well	$\frac{gsFf}{L}$	quartzite, mudstone		D.DYB	sil	-	non
770025	-	800	4	120	lower slope	mesic	well	sFt	-	FN 1	O.HFP	s	-	non
770102	-	790	35	40	lower slope	mesic	well	Cb	-	WD 2	LO.EB	l	-	non
770221	-	1010	21	5	lower slope	mesic	well	Cv	-	WD 1	LO.HFP	sil	-	non
770220	-	1030	9	310	lower slope	subhygric	well	sgFt	-	PM 1	O.HFP	s	-	non
770223	-	910	12	38	middle slope	-	mod. well to imper.	Cv	-	WD 1	D.DYB	l	-	non
770212	-	840	5	208	lower slope	mesic	imper.	L	-	RH 1	GL.GL	sic	-	non
770104	-	800	42	320	lower slope	mesic	well	gFt	-	FN 1	O.HFP	s	-	non
770233	-	800	6	238	lower slope	mesic	mod. well	L/F^G	-	LO 4	PZ.GL	-	-	non
770046	-	790	5	258	lower slope	subhygric	imper.	F	-	LZ 7	BR.GL	c	-	non
770245	-	920	10	28	lower									

770233	-	800	6	238	lower slope	mesic	mod. well	L/F^G	-	LO 4	PZ.GL	-	-	non
770046	-	790	5	258	lower slope	subhygric	imper.	F	-	LZ 7	BR.GL	c	-	non
770245	-	920	10	28	lower slope	submesic	mod. well	L	-	LO 4/ LO 7	LU.P	c	-	non
770122	-	960	47	18	lower slope	mesic	mod. well	Cb/F	-	WD 5	O.FHP	s	-	non
770010	-	870	10	230	lower slope	mesic	mod. well	L	-	RH 4	O.GL	c	-	non
770121	-	960	9	122	lower slope	mesic	well	Ft	-	PM 1	O.HFP	s	-	non
770247	-	930	0	level	lower slope	mesic	well	sF^G	-	PM 1	O.HFP	s	-	non
770120	-	1190	34	130	middle slope	mesic	-	Cb	-	WD 1	O.HFP	ls	-	non
770006	-	810	2	110	lower slope	mesic	well	Lv/F^G	-	PM 1	O.HFP	s	-	non
770168	ACH14	960	1-3	310	lower slope	mesic	well	sFt	quartzite, sandstone	FG 1	O.HFP	s	4.3	non
770210	-	750	30	18	lower slope	mesic	rapidly	Cv	-	WD 1	L.R	-	-	non
770172	ACH16	710	3	346	middle slope	subhygric	imper.	sLt	-	RH 7	GL.GL	sl	-	non
770199	ACH38	970	33	60	lower slope	mesic	mod. well	sLt	-	RH 4	BR.GL	s	-	non
770017	-	770	5	58	lower slope	mesic	well	gFf	-	PM 1	O.HFP	s	-	non
770211	-	760	0	level	lower slope to valley floor	mesic	well	gFt	-	PM 1	O.HFP	s	-	non
770048	-	760	25	210	lower slope	subhygric	imper.	L	-	RH 7	GL.DYB	c	-	non
770165	ACH12	940	1.5	100	lower slope	subhygric	poorly	sLl	-	RH 3	BR.GL	sl	4.0	non
770182	ACH23	940	16	230	lower slope	mesic	well	fgFf	-	PM 1	O.HFP	s	-	non
770248	-	820	0	level	lower slope	mesic	imper.	L	-	RH 7	GL.GL	c	-	non
770139	RMH15	470	5	160	lower slope	mesic	mod. well	sFt	limestone, sandstone	PM 1 or OY 1	O.HFP	s	3.9	w
770219	-	1050	6	344	middle slope to lower slope	subhygric	imper.	sFt	-	PM 8	.G	cl	-	non

TABLE C.25: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 25

Type 25	Western hemlock - western red cedar - oval-leaved blueberry - Canadian bunchberry - five-leaved creeping raspberry													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770255	-	900	5	60	lower slope	mesic	mod. well	L	-	RH 3	BR.GL	c	-	non
770214	-	820	20	324	lower slope	mesic	well	sFt	-	PM 1	O.HFP	sl	-	non
770003	-	870	0	-	lower slope	hygric	poorly	L^G	-	RH 8	O.GL	c	-	non
770009	-	870	4	160	lower slope	mesic	imper.	L	-	RH 1	O.GL	c	-	non
770213	-	830	12	162	lower slope	mesic	well	sFt	-	PM 1	O.HFP	s	-	non
770254	-	900	14	52	lower slope	mesic	well	sF^G/Mb	-	PM 1	O.HFP	s	-	-
770011	-	880	2	228	middle slope	subhygric	imper.	L/Mb	-	RH 1	.GL	c	-	non
770016	-	850	5	200	lower slope	subhygric	imper.	Mb	-	LZ 7	O.GL	c	-	non
770021	-	800	0	level	lower slope	mesic	well	F^{G}t	-	PM 1	O.HFP	s	-	non
770244	-	920	5	290	lower slope	mesic	mod. well	L	-	LO 4	LU.P	sicl	-	non
770007	-	850	0	-	lower slope	hygric	poorly	L	-	RH 8	.GL	c	-	non
770217	-	740	28	336	lower slope	mesic	-	sFt	-	LO 2	O.HFP	s	-	non
770161	RMH27	880	18	290	lower slope	mesic	well	ssF^G (t)	-	LO 1	O.HFP	s-ls	4.2	non
770026	-	880	3	50	lower slope	mesic	well	gFt	-	PM 1	O.HFP	s	-	non
770243	-	920	11	208	lower slope	mesic	mod. well	sL	-	RH 1	O.GL	sc	-	non
770001	-	830	0	level	lower slope	hygric	imper.	Lm	-	RH 7	O.GL	c	-	non
770184	ACH25	900	0	level	valley floor	mesic	well	sFt	-	OV 1	O.HFP	s	-	non
770013	-	850	0	level	lower slope	subhygric	poorly	L	-	RH 7	O.GL	c	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.26: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 26

Type 26	Rocky Mountain Douglas-fir - western red cedar - western hemlock - common western pipsissewa - many-flowered one-sided wintergreen													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770022	-	810	0	level	lower slope	mesic	-	$F^G t$	-	PM 1	O.HFP	s	-	non
770231	-	800	0	level	lower slope	mesic	well	F^G	-	PM 1	O.HFP	s	-	non
770049	-	760	33	220	lower slope	submesic	well	Cv	quartzite	WD 5	LO.HFP	sl	-	non
770222	-	920	25	40	lower slope	mesic	rapidly	Cv	-	WD 1	LO.HFP	sl	-	non
770234	-	810	8	204	lower slope	mesic	mod. well	Mb	-	LZ 1	O.HFP	s	-	non
770232	-	730	25	300	lower slope	mesic	well	sgFt	-	LO 2	D.DYB	s	-	non
770020	-	850	38	58	middle slope	mesic	mod. well	Cb	-	WD 2	O.HFP	sil	-	non
770045	-	790	15	52	-	-	well	Mb/R	quartzite	LZ 5	LO.HFP	scl	-	non
7700224	-	900	29	50	middle to lower slope	mesic	rapidly	Cv	-	WD 1	LO.HFP	s	-	non
770135	-	940	14	222	middle slope	mesic	well	Ff	schist	LO 2	D.DYB	s	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.27: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 27

Type 27	Common paper birch - Sitka willow - birch-leaved spirea - Douglas' aster													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH ($CaCl_2$) (0-30 cm)	CAL.[1] (C horizon)
770170	-	730	8	190	lower slope	mesic	well	Cf	-	WD 2	-	-	-	non
770023	-	740	41	260	lower slope	mesic	well	F^G	-	PM 4	BR.GL	l	-	non
770241	-	870	11	197	lower slope	mesic	mod. well	Mb	-	LZ 2	-	ls	-	non
770240	-	790	13	210	lower slope	mesic	well	Mv/Cv	-	WD 2	PZ.GL	c	-	
770134	-	1290	32	230	middle slope	submesic	well	Cb	-	HL 2	D.DYB	l	-	non
770239	-	790	16	224	lower slope	mesic	well	Cv/R	-	WD 2	D.DYB	sl	-	non
770047	-	840	9	44	apex	subxeric	-	R	-	RK 9	L.R	-	-	-
770225	-	790	3	320	lower slope	subhygric	imper.	Ft	-	PM 8	O.HG	c	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

TABLE C.28: SOILS AND ENVIRONMENT INFORMATION FOR VEGETATION TYPE 28

Type 28	Lodgepole pine - black spruce - bog glandular birch - bog cranberry - narrow-leaved cotton-grass													
Vegetation Plot Number	Soil Survey Number	Elevation (m)	Slope (°)	Aspect (°)	Landscape Position	Moisture Regime	Drainage	Landform	Lithology	Soil Association Component	Soil Development	Soil Texture	pH (CaCl$_2$) (0-30 cm)	CAL.[1] (C horizon)
770018	-	830	0	level	lower slope	subhydric	very poorly	Ob	-	CC 6	.M	mesic	-	non
770008	-	830	0	level	lower slope	subhydric	poorly	Ob	-	CC 4	TY.F	fibric	-	non
770002	-	870	0	level	lower slope	subhydric	very poorly	OvL	-	CC 6	.HG	fibric	-	non
770014	-	850	0	level	lower slope	subhydric	poorly to very poorly	Ob	-	CC 5	TY.M	fibric	-	non
770012	-	850	0	level	valley floor	-	imper. to poorly	Ob	-	CC 4	.F	fibric	-	non
770246	-	920	0	level	lower slope	subhydric	very poorly	Ob	-	CC 4	TY.M	mesic	-	non
770039	-	730	0	level	lower slope	subhygric	very poorly	-	-	CC 1	.F	-	-	non
770100	-	790	4	40	lower slope	subhydric	imper.	Ob	-	CC 4	TY.F	fibric	-	non
770163	ACH10	780	0	level	valley floor	subhydric	very poorly	Ob	-	CC 4	.M	fibric	-	-
770101	-	790	0	level	lower slope	hygric	poorly	Ob	-	CC 4	TY.F	fibric	-	non
770040	-	730	0	level	lower slope	subhydric	very poorly	Ob	-	CC 1	.F	mesic	-	non

[1] non = non-calcareous, w = weakly calcareous, m = moderately calcareous, s = strongly calcareous.

APPENDIX D
LIST OF NORTHEAST COAL STUDY REPORTS 1976-1988

A. ENVIRONMENT AND LAND USE SUBCOMMITTEE

Environment and Land Use Subcommittee on Northeast Coal Development. May, 1977. Northeast Coal Study - Preliminary Environmental Report on Proposed Transportation Links and Townsites. Victoria, British Columbia. 141 pp. plus maps and appendices.

Environment and Land Use Subcommittee on Northeast Coal Development. October, 1978. Northeast Coal Study - Preliminary Environmental Report 1977-1978. Victoria, British Columbia. 173 pp. plus appendices.

B. RESOURCE ANALYSIS BRANCH

Reimchen, T. H. F., J. D. Miller, I. D. Thompson and G. B. Bihl. October, 1976. Terrain Analyses and Erosion Potential of Northeast Coal Block Study Area. Bayrock and Reimchen Surficial Geology Ltd. North Vancouver, British Columbia. 32 pp. plus appendices.

Vold, T. December, 1977. Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1976-1977 - Volume One. Analysis/Interpretation Division, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 68 pp. plus map.

Vold, T., R. Maxwell and R. Hardy. December, 1977. Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1976-1977 - Volume Two. Analysis/Interpretation Divison, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 197 pp.

Harcombe, A. March, 1978. Vegetation Resources of the Northeast Coal Study Area, 1976-1977. Resource Inventory Division, Resource Analysis Branch, British Columbia Ministry of Environment. Kelowna, British Columbia. 46 pp. plus appendices.

Ceska, A. May, 1979. Northeast Coal Study Area, 1977-1978: A List of Vascular Plant Species. Kelowna Division, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 37 pp.

Harding, E. A. January, 1979. Aquatic Systems Units of the Northeast Coal Study Area. Analysis/Interpretation Division, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 33 pp.

Miles, M. and E. A. Harding. January, 1980. Aquatic Inventory and Analysis in the Vicinity of the Proposed Tumbler Ridge Townsite. Analysis/Interpretation Divison, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 49 pp.

Miles, M. May 1981. Regional Hydrology of the Northeast Coal Study Area. Assessment and Planning Divison, British Columbia Ministry of Environment. Victoria, British Columbia.

APPENDIX D (CONTINUED)

Bindernagel, J. *et al*. June, 1976. *A Review of the Data Base for Wildlife Investigations in the Northeast Coal Area*. Wildlife Sector, E.L.U.C. Secretariat. 49 pp. plus 35 maps.

Resource Analysis Branch, in collaboration with the Fish and Wildlife Branch. November, 1977. *Wildlife Resources of the Northeast Coal Study Area 1976-1977*. Analysis/Interpretation Division, Resource Analysis Branch, British Columbia Ministry of Environment. Victoria, British Columbia. 58 pp. plus appendices.

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